

FINAL (90%) SPECIFICATIONS

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BASIN F LIQUID
STORAGE TANK 102
DECONTAMINATION
FIELD DEMONSTRATION
ROCKY MOUNTAIN ARSENAL,
COLORADO

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Prepared for
U.S. Department of the Army
Corps of Engineers, Omaha District
Omaha, Nebraska
July 1992

Woodward-Clyde 

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BIDDING SCHEDULE

Item	Quantity	Unit	Unit Cost	Extended Cost
1. All Other Work	Job		LS	\$ _____
2. Emission Control System Instal.	Job		LS	\$ _____
3. Granular Activated Carbon (GAC)	3	Month	\$ _____	\$ _____
4. Emission Control System Oper.	90	Calendar Day	\$ _____	\$ _____
5.a Heat Source	Job		LS	\$ _____
5.b Heat Source	2	Month	\$ _____	\$ _____
6. Recirculation System Installation	Job		LS	\$ _____
7. Heating and Recirculation System Operation	30	Calendar Day	\$ _____	\$ _____
8. Tank Decontamination	Job		LS	\$ _____
9. Remove, Package, and Transport Sludge and Sediments	850	Drum	\$ _____	\$ _____
10. Transportation and Handling of Dissolution Liquids (Optional)				
10.1 0 to 100,000 gallons	100,000	Gallons	\$ _____	\$ _____
10.2 100,000 to 150,000 gallons	50,000	Gallons	\$ _____	\$ _____
10.3 150,000 to 200,000 gallons	50,000	Gallons	\$ _____	\$ _____
10.4 Over 200,000 gallons	50,000	Gallons	\$ _____	\$ _____
11. Transportation and Disposal of Contaminated Materials	6	Ton	\$ _____	\$ _____
12. Health and Safety				

12.1	Level B		Work Day	\$_____	\$_____
12.2	Level C		Work Day	\$_____	\$_____
12.3	Level D		Work Day	\$_____	\$_____
12.4	Health and Safety Systems	90	Calendar Day	\$_____	\$_____
12.5	Heat Stress Equipment		Work Day	\$_____	\$_____
12.6	Swing Shift Premium			_____%	
13.	Chemical Data Management				
13.1	Air Sampling	90	Calendar Day	\$_____	\$_____
13.2	Dissolution Liquid Sampling	10	Calendar Day	\$_____	\$_____
13.3	Landfill Compliance Sampling	Job		LS	\$_____

Notes

1. All quantities represent the best estimate at time of bidding and are for purposes of evaluation only. No modifications to the fixed unit price quoted will be allowed for variations in quantities.
2. Bid prices must be entered for all items of the schedule, except item 5. Item 5 may be bid 5a only, 5b only or a combination of 5a and 5b. Total amount bids submitted without bid prices being entered on individual items will be rejected. Extensions will be subject to verification by the Government. In case of variation between the unit price and the extension, the unit price will be considered the bid. In case of variation between the individual bid item prices and the total amount, the individual bid prices will be considered the bid.

ZERO ACCIDENTS

SECTION 01010

SUMMARY OF WORK

1. GENERAL

1.1. REFERENCES. The publications listed below form a part of this specification to the extent referenced.

1.1.1. Draft Final Alternatives Evaluation for Basin F Ponds and Tanks Decontamination, March 1992. (Alternatives Evaluation)

1.2. BACKGROUND. The Rocky Mountain Arsenal (RMA) was established in 1942 and has been the site of manufacture of chemical incendiary munitions, and chemical munitions demilitarization. Industrial chemicals were manufactured at RMA from 1947 to 1982. Disposal practices at RMA have included routine discharge of industrial and munitions aqueous waste effluents to evaporation ponds.

In 1956, Basin F was constructed in the northern part of RMA as an aqueous waste disposal unit. From August 1957 until its use was discontinued in December 1981, Basin F was the only evaporative disposal facility in service at RMA. In 1986, the Department of the Army, Shell Chemical Company, EPA Region VIII, and the Colorado Department of Health agreed that an emergency remediation be undertaken to contain the liquid and contaminated soils in and under the Basin F. This effort was initiated under the Comprehensive Environmental Response Liability and Compensation Act (CERCLA) Interim Response Action (IRA) Program.

Since initiation of the IRA Program, the former contents of Basin F have been transferred to three above-ground storage tanks (Tanks 101, 102, and 103) and to Pond A, a double-lined surface impoundment. Approximately 8.5 million gallons of liquid waste are presently stored in this way; approximately 1.33 million gallons in each of the three tanks and 6.5 million gallons in Pond A.

As part of the IRA Program, a study was conducted to select a technology for treatment and disposal of the Basin F liquids stored in the tanks and pond. Submerged quench incineration (SQI) was selected.

The SQI system is under construction and start-up, testing and trial burn are scheduled for the last quarter of 1992 and the first quarter of 1993. Removal and treatment of the Basin F liquid in Tank 102 will begin during the start-up and trial burn and is scheduled to be completed during operation of the facility through the second quarter of 1993.

Measurements conducted during the period that Basin F liquid has been stored indicate that a layer of solid material is present in the bottom of the tanks. This solid layer primarily consists of inorganic salts precipitated from the saturated liquid and insoluble sediments. A study was conducted to assess the quantities of solid material present, obtain samples of the material for laboratory testing, and conduct bench tests to demonstrate methods for redissolving the salt crystals to produce a liquid which may be treated in the SQI facility. The results of these studies are presented in the Alternatives Evaluation. This report also includes an evaluation of conceptual methods for dissolution of solids and decontamination of the tanks. Based on this study, the Project Managers' Office at RMA has decided to implement a demonstration of the in situ conceptual design for solid dissolution and tank decontamination for Tank 102.

1.3. PROJECT DESCRIPTION. The purpose of this project is to demonstrate the in situ dissolution of soluble solids present in Tank 102 and subsequently to decontaminate the tank. The Contractor shall provide all the labor and materials necessary to implement the project as described on the Drawings and in these specifications. The project will be initiated after the Basin F liquid present in the tank has been removed. The removal of Basin F liquid will be done by the operator of the SQI facility separate from this contract. The description of this project can be conveniently divided into two phases.

1.3.1. Phase One - Tank 102 Content Heating and Crystal Dissolution. The purpose of this phase of the project is to dissolve the soluble solids present in the tank. This will be done by adding an unsaturated liquid to the tank and operating a liquid heating and closed-loop circulation system to

raise the temperature of the liquid in the tank to produce dissolution. The liquid used may be water or dilute Basin F liquid taken from the upper strata of Pond A. Based on the results of the Alternatives Report, a maximum temperature of 60 C will be used and complete dissolution of all soluble material present is expected to occur within one week of operation. The contractor will install the necessary equipment and operate the system as directed during this period. It is anticipated that after installation, operations of the liquid heating and circulation system and emission control system will be limited to a maximum of 5 days during phase one operations. It is anticipated that system operations will require the Contractor to provide the following personnel: An Emission Control System Operator to operate and monitor system and collect necessary data and samples; Heating and Circulation System Operator to operate and monitor system and collect necessary data and samples; and a Supervisor/Health and Safety Officer. Significant evolution of ammonia, toxic, organic and odor vapors may occur inside the tank during the liquid heating. An emission control system must be operated during this time to create a negative pressure in the tank headspace to prevent fugitive odor emissions. The vapors withdrawn from the tank must be treated using a combination of an ammonia scrubber and a granular activated carbon (GAC) adsorption system. When the dissolution of the soluble solids is complete the liquid will be transferred from Tank 102 to Pond A. The second phase of the project will then be implemented.

1.3.2. Phase Two - Tank 102 Interior Decontamination. This phase includes removal and packaging of the remaining insoluble solids (sludges), decontamination and disposal of the tank liner material, and decontamination of the tank walls and cover. An access opening will be cut in the tank wall to allow personnel to enter the tank and remove the sludge present. The volume of sludge is estimated to be 180 cubic yards. These solids will be dewatered in situ, removed using skid steer loaders, then placed in drums, and delivered to a storage facility at RMA. The tank liner material will then be decontaminated, removed, and disposed at a appropriate off-site disposal facility. The tank walls and cover will then be decontaminated. An emission control system will be operated during this work to maintain a flow of air into the tank through the access opening. The vapors withdrawn from the tank must be treated using a combination of an ammonia scrubber and a GAC air filter.

ZERO ACCIDENTS

SECTION 01025 MEASUREMENT AND PAYMENT

1. ALL OTHER WORK

1.1 Work Included. The work of this item shall include but not be limited to Contractor supervision, field office personnel; mobilization; demobilization; site preparation; site utilities (i.e., telephone, electricity, water, etc.); other indirect costs; insurance; safety; training; personnel and equipment decontamination; and seeding.

1.2 Measurement. Lump Sum

1.3 Payment. Payment for this item shall be a lump sum, as follows; 10% after the Contractor has submitted and received approval for the Health and Safety Plan and the Chemical Data Management Plan; 20% after the Contractor has installed all required utilities and the administrative area, 15% after installation and acceptance by the Contracting Officer of the Emission Control System and Heating and Recirculation System, 15% after completion of site preparation and all preliminary installations for the tank decontamination, and the remaining 40% after completion of demobilization.

2. EMISSION CONTROL SYSTEM INSTALLATION

2.1 Work Included. The work of this item shall include but not be limited to purchase, fabrication, installation, startup testing, decontamination, and removal of the emission control system. All costs associated with operation of this system shall be paid for under Item 4 Emission Control System Operation.

2.2 Measurement. Lump Sum

2.3 Payment. Payment for this item shall be a lump sum, on a progressive basis, as follows: up to 40% of the total based on submittal of invoices for equipment and materials delivered to the site, 20% of total after installation, startup, and acceptance by the Contracting Officer, 20% at the conclusion of Phase 1, the remainder at the conclusion of demobilization.

3. GRANULAR ACTIVATED CARBON (GAC)

3.1 Work Included. The work of this item shall include but not be limited to the lease, transportation, installation, startup testing, removal, and rejuvenation of the granular activated carbon units for the emission control system.

3.2 Measurement. Per Month.

3.3 Payment. Payment for this item shall be made per month or fraction of a month, linearly prorated, that the GAC unit is needed for fabrication, startup testing, or operation on site as agreed to by the Contracting Officer.

4. EMISSION CONTROL SYSTEM OPERATION

4.1 Work Included. The work for this item shall include but not be limited to the personnel, sampling, startup testing, maintenance, scrubber solution, and repair necessary for the continuous operation of the emission control system during all intrusive phases of the project.

4.2 Measurement. Per Calendar (24 hour) Day.

4.3 Payment. Payment for this item shall be made per day or fraction of a day, linearly prorated, that the emission control System is needed for operation as agreed to by the Contracting Officer.

5. HEAT SOURCE

5.1 Work Included. The work for this item shall include but not be limited to the purchase/lease of a heat source(s) and heat transfer fluid which meet the requirements of the specifications. This work shall also include any fabrication, installation, and startup testing necessary.

5.2 Measurement. Lump Sum. This item may be bid alternately as a lease

item, if available. In that case the Measurement will be Per Month.

5.3 Payment. Payment for this item shall be made as follows: payment based on submittal of invoices for equipment and materials delivered to the site up to 40% of total, 20% of total after installation and startup testing to the Contracting Officer's satisfaction, 20% of total after completion of Phase 1, payment of the remainder of the total at the conclusion of demobilization. If bid as a lease item the Payment shall be made per month or fraction of a month, linearly prorated, that the heat source is needed for installation, startup testing, or operation of the heating and recirculation system as agreed to by the Contracting Officer.

6. RECIRCULATION SYSTEM INSTALLATION

6.1 Work Included. The work for this item shall include but not be limited to the purchase, fabrication, installation, startup testing, decontamination, and demobilization of the piping (including the piping from the heat source to the heat exchanger), valves, instrumentation, sample ports, heat exchangers, pumps, and appurtenances. All costs associated with the operation of this system shall be paid for under the item Heating and Recirculation System Operation.

6.2 Measurement. Lump Sum.

6.3 Payment. Payment for this item shall be made as follows: payment based on submittal of invoices for equipment and materials delivered to the site for up to 40% of total, 20% of total after installation and testing to the Contracting Officer's satisfaction, 20% of total after completion of Phase 1, payment of the remainder at the conclusion of demobilization.

7. HEATING AND RECIRCULATION SYSTEM OPERATION

7.1 Work Included. The work for this item shall include but not be limited to the operation of the heat source and recirculation system, sampling, startup testing, maintenance, and repair necessary for the safe operations as described in the specifications.

7.2 Measurement. Per Calendar (24 hour) Day.

7.3 Payment. Payment for this item shall be made per day or fraction of a day, linearly prorated, that the Heating and Recirculation System is needed for operation as agreed to by the Contracting Officer.

8. TANK DECONTAMINATION

8.1 Work Included. The work for this item shall include but not be limited to the installation, operation, and demobilization of the lighting system; the installation, operation, and demobilization of the decontamination and dewatering system; the purchase, installation, operation, and demobilization of the automatic tank washer; the transfer of decontamination water to the tank, and the handling and transportation of the decontamination water to the CERCLA facility; the removal and decontamination of the liner and geonet; and the decontamination of the tank wall, bottom, roof, and appurtenances.

8.2 Measurement. Lump Sum.

8.3 Payment. Payment for this item shall be a lump sum, on a progressive basis, as follows: payment based on submittal of invoices for equipment and materials delivered to the site up to 40% of the total, 20% of the total after the installation and testing of the settling tanks, the dewatering system, and the temporary heating and recirculation system, 20% after the conclusion of Phase 2, and the remainder after final demobilization.

9. REMOVE, PACKAGE, AND TRANSPORT SLUDGE AND SEDIMENTS

9.1 Work Included. The work for this item shall include but not limited to the fabrication, installation, equipment, and labor necessary for the removal of any free liquid from the sludge, removal of the sludge, drumming, handling, and transportation of the sludges, sediments, and other insoluble debris removed from the tank during sludge removal, decontamination, or other operations.

9.2 Measurement. Per Drum. Drums will be 55-U.S. Gallon poly drums supplied by the Contracting Officer. The quantity will be determined by the number of drums filled to 80% capacity or greater that are transported to Building 785 for storage.

9.3 Payment. Payment for the item shall be based on the unit price per 55-U.S. Gallon drum, times the number of drums received at Building 785. Estimated quantities are for evaluation purposes only. No contract modifications shall be allowed due to variations in quantity.

10. TRANSPORTATION AND HANDLING OF DISSOLUTION LIQUID (OPTIONAL)

10.1 Work Included. The work for this item shall include but not be limited to the collecting, pumping, temporary storage, handling, metering, sampling and testing, transporting, and disposing of all liquids generated during dissolution.

10.2 Measurement. Per U.S. Gallon. The quantity of liquids shall be determined based on the number of U.S. Gallons delivered to Pond A or to the Submerged Quench Incinerator by tank truck as directed by the Contracting Officer. Measurement shall be performed by the Contractor in the presence of the Contracting Officer.

10.3 Payment. Payment for this item shall be based on the unit rate per U.S. Gallon times the number of U.S. Gallons delivered for disposal.

11. TRANSPORTATION AND DISPOSAL OF CONTAMINATED MATERIALS

11.1 Work Included. The work for this item shall include but not be limited to temporary storage, preparation of manifests, loading, transporting, payment of fees associated with disposal of contaminated materials. Sampling and Testing for compliance with all applicable landfill disposal criteria shall also be included in this item.

11.2 Measurement. Per Ton. Measurement shall be made in the presence of a Government inspector or certified weighmaster by weighing at RMA. Each weight slip shall contain the following: date, unit number, gross weight, time of gross weight, tare weight, time of tare weight, name of project, contract number, name of Contractor, and signature of weighmaster.

11.3 Payment. Payment for transportation and disposal of contaminated materials shall be based on the unit price per ton times the number of tons disposed of.

12. HEALTH AND SAFETY

12.1 Work Included. The work for this item shall include but not be limited to providing and maintaining personal protective equipment including respirator cartridges and supplied air; usage of the decontamination trailer; miscellaneous supplies; positive barriers separating the support zone, contamination reduction zone, and exclusion zone; monitoring equipment; real time and personnel air sampling and analysis; air technicians; and safety spotters.

12.2 Measurement. Per Work Day for each level of protection. The quantity for measurement will a price per person per day in Level B, C, and D and include the costs for equipment, respirator cartridges, supplied air, and personal air sampling. Additionally, a per person per day rate for heat stress equipment (cooling vests or vortex suits). Per Calendar (24 hour) Day for Health and Safety Systems including: usage of the decontamination trailer, exclusion zone decontamination setups, handling of spent PPE, real time air monitoring, air technicians, and safety spotters. Also the Contractor will supply a percent premium for manpower for working a swing shift (midnight to 11:00 am).

12.3 Payment. Payment shall be made at the unit rate for each applicable unit for the level of protection required by the Contractor's Health and Safety Plan. If a person requires more than one level of protection in a day, only the highest unit rate will be applied. Payment for Health and Safety Systems will be made on a Per Day basis once intrusive operations begin and ceasing when all on site decontamination is completed. Heat stress equipment and swing shift will be used only with approval of the Contracting Officer and in strict compliance with the Contractor's Health and Safety Plan.

13. CHEMICAL DATA MANAGEMENT

13.1 Work Included. The work for this item shall include but not be limited to supplying all equipment, sample media, sample containers, and instruments; sampling, handling, manifesting, transporting, analyzing,

reporting, and disposal of all samples required in Section 1402, Chemical Data Management.

13.2 Measurement. Per Calendar Day for air or water samples. A day shall be counted if activities during that day require sampling or monitoring according to the Chemical Data Management Plan.

13.3 Payment. Payment for this item shall be based on the unit price per day indicated on the Proposing Schedule times the number of days of sampling required by the Chemical Data Management Plan as counted by the Contracting Officer.

ZERO ACCIDENTS

SECTION 01100
SPECIAL CLAUSES

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1. **COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK.** The Contractor shall commence work under this contract within ten (10) calendar days after the date of receipt by him of Notice to Proceed, prosecute said work diligently, and complete the entire work except seeding ready for use not later than 365 calendar days after receipt of Notice to Proceed. The time stated for completion shall include final cleanup of the premises.

1.1. **START WORK.** Evidence that the Contractor has started procurement of materials, preparation and submission of shop drawings, preparation of subcontracts, and other preparatory work will satisfy the requirement that work commence within ten (10) calendar days after receipt of Notice to Proceed. Therefore, work need not be commenced at the construction site within ten (10) calendar days. (based on FAR 52.212-3)

2. (NOT USED)

2A. ORDER OF WORK. Phase 1. Tasks include:

- Mobilize
- Install Emission Control System
- Install Heating and Recirculation System
- Dissolve the Crystals
 - Operate Emission Control System
 - Operate Heating and Recirculation System
- Remove Dissolution Liquid

Phase 2. Tasks include:

- Site Preparation
- Remove Sludge
- Decontaminate and Remove Liner and Geonet
- Decontaminate Tank Wall, Floor, and Roof
- Transport Contaminated Materials to Off-site Landfill for Disposal
- Demobilize

3. DRAWINGS AND SPECIFICATIONS.

3.1. SETS FURNISHED. Twenty-five (25) sets of half-size bid drawings (only if delivery order drawings are unavailable when Notice to Proceed is issued) and specifications including amendments (except applicable publications incorporated into the Technical Provisions by reference) will be mailed to the Contractor when the Notice To Proceed is issued. The request for proposal drawings as amended shall be utilized in the performance of the work until delivery order drawings (i.e., bid drawings that have been posted with all amendment changes) are mailed to the Contractor. Thirty (30) sets of delivery order drawings (5 sets full size and 25 sets half-size) will be mailed to the Contractor as soon as possible, but no later than sixty (60) days after Notice to Proceed. The work shall conform to the delivery order drawings, set out in the drawing index, all of which form a part of these specifications. The work shall also conform to the standard details bound or referenced herein.

3.2. NOTIFICATION OF DISCREPANCIES. The Contractor shall check all drawings furnished him immediately upon their receipt and shall promptly notify the Contracting Officer of any discrepancies. Dimensions marked on drawings shall be followed in lieu of scale measurements. Enlarged plans and details shall govern where the same work is shown at smaller scales. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

3.3. OMISSIONS. Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.

4. **SUBMITTALS.** See Section 01305 - Submittal Procedures.

4.1. **SUBMITTALS REQUIRED BY THIS SECTION** shall be in accordance with Section 01300 Submittal Descriptions.

SD-07 SCHEDULES

Equipment List; FIO (Para. 4, 24.1); Equipment list shall be all inclusive.

Guarantees; FIO (Para. 4, 24.2). A list of guaranteed equipment with copy of guarantees shall be provided.

SD-18 RECORDS

Project Record Documents; FIO; (Para. 4, 40.1)

Project Photographs; FIO; (Para. 4, 41.1)

5. **PHYSICAL DATA.** Pursuant to: "Site Investigation and Conditions Affecting the Work," information and data furnished or referred to below are furnished for general information only and the Government may not be held liable for any interpretation or conclusions drawn therefrom by the Contractor.

5.1. **SOURCE OF DATA.** The physical conditions indicated on the drawings and in the specifications are the result of as-builts from the tank manufacturer.

5.2. **WEATHER.** Weather conditions shall have been investigated by the Contractor to satisfy himself as to the hazards likely to arise therefrom. Complete weather records and reports may be obtained from the local U.S. Weather Bureau.

5.3. **ACCESS ROUTES.** Transportation facilities shall have been investigated by the Contractor to satisfy himself as to the existence of access highways and railroad facilities. (based on FAR 52.236-4)

5.4. **CONCURRENT CONSTRUCTION.** Construction work closely related to and/or located at the site of the work under this contract, including Submerged Quench Incinerator (SQI) operations will be in progress simultaneously with work under this contract. The location of this concurrent work is shown on the drawings or described in these specifications. The Contractor shall cooperate with others as necessary in the interest of timely completion of all work. In the event of interference, the Contracting Officer shall be notified immediately for resolution and his decision shall be final.

6. **PAYMENT.**

6.1. **PROMPT PAYMENT ACT.** Pay requests authorized in "Payments Under Fixed-Price Construction Contracts", will be paid pursuant to the "Prompt Payment for Construction Contracts". Pay requests will be submitted on ENG Form 93 and 93a, "Payment Estimate-Contract Performance" and "Continuation". All information and substantiation required by the identified delivery order clauses will be submitted with the ENG Form 93, and the required certification will be included on the last page of the ENG Form 93a, signed by an authorized contractor official and dated when signed. The designated billing office is the Office of the Area Engineer.

6.2. **PAYMENTS FOR MODIFICATIONS.** Payments may be made for cost bearing change orders within the scope of the delivery order only to the extent funds are authorized in the order on a two-part modification. Contractor pricing proposed

must be submitted at the earliest possible time after the change order is issued, or at a specific time as directed by the Contracting Officer. At the discretion of the Contracting Officer, any and all payments may be withheld on the modification until the Contractor has submitted a qualifying price proposal, in as much detail as required by the Contracting Officer, and the final price has been agreed.

6.3. PAYMENT FOR MATERIALS DELIVERED OFFSITE. In accordance with "Payments Under Fixed-Price Construction Contracts," the Contracting Officer, at his discretion, may authorize material delivered to the Contractor at locations other than the site be taken into consideration in the preparation of payment estimates. Such materials delivered to the Contractor offsite will only be considered if the Contractor furnishes satisfactory evidence that he has acquired title to such material and that it will be utilized in the work covered under this delivery order.

7. AVAILABILITY OF UTILITY SERVICES. All reasonably required amounts of domestic water and electricity will be made available to the Contractor by the Government from existing system outlets and supplies. The Contractor shall, at his own expense, make all temporary connections and install distribution lines. The Contractor shall furnish to the Contracting Officer a complete system layout drawing showing type of materials to be used and method of installation for all temporary electrical systems. Meters shall be installed by the Contractor to determine the amount of water and electricity used by him, and such utilities will be paid for by or charged to the Contractor. All temporary lines shall be maintained by the Contractor in a workmanlike manner satisfactory to the Contracting Officer and shall be removed by the Contractor in like manner prior to final acceptance of the construction. Normal quantities of electricity and water used to make final tests of completely installed systems will be furnished by the Government. (based on FAR 52.236-14)

8. UTILITY SERVICE INTERRUPTIONS. The Contractor shall submit written notification not less than 15 calendar days in advance of each interruption of each utility and communication service to or within existing buildings and approved in writing. The time and duration of all outages will be coordinated with the Using Agency by the Contracting Officer.

8A. DIGGING PERMITS AND ROAD CLOSINGS. The Contractor shall allow 14 calendar days from date of written application to receive permission to dig and to close roads. Roads shall only be closed one lane at a time and vehicular traffic shall be allowed to pass through the construction area. Work on or near roadways shall be flagged in accordance with the safety requirements in Safety and Health Requirements Manual EM 385-1-1, which forms a part of these specifications. Work located along the alert force route shall not cause blockage and the Contractor shall maintain unobstructed access for alert force traffic at all times.

9. LAYOUT OF WORK. The Contractor shall lay out his work from Government established base lines and bench marks indicated on the drawings and shall make all measurements in connection therewith. The Contractor shall furnish all stakes, templates, platforms, equipment, tools, and materials and labor as may be required in laying out any part of the work from the base lines and marks established by the Government. The Contractor shall execute the work to the lines and grades established or indicated and shall maintain and preserve all

stakes and other control points established by the Contracting Officer until authorized to remove them. If such marks are destroyed by or through negligence of the Contractor, prior to their authorized removal, they may be replaced by the Contracting Officer at his discretion and the expense of replacement will be deducted from any amounts due or to become due the Contractor. (based on FAR 52.236-17)

10. NOT USED

10A. NOT USED

10B. NOT USED

11. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER.

11.1. This clause specifies the procedure for the determination of time extensions for unusually severe weather in accordance with "Default: (Fixed-Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

11.1.1. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

11.1.2. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

11.2. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(07)	(04)	(04)	(04)	(06)	(03)	(04)	(02)	(03)	(03)	(02)	(05)*

11.3. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the delivery order, the contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 11.2. above, the contracting officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the "Default (Fixed Price Construction)".

12. NOT USED.

13. NOT USED.

13A. NOT USED.

14. **SECURITY REQUIREMENTS.** The Contractor shall furnish to each employee and require each employee engaged on the work to display, such identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer, for cancellation upon release of any employees. When the contract involves work in restricted security areas, only employees who are U.S. citizens will be permitted to enter. Proof of U.S. citizenship is required prior to entry. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project. (based on FAR 52.204-2)

14A. NOT USED.

15. **CONTRACTOR QUALITY CONTROL (CQC).** See Section 01440 - Contractor Quality Control.

16. **NONDOMESTIC CONSTRUCTION MATERIALS.** The requirements of this delivery order entitled Buy American Act Construction Materials do not apply to construction materials or their components included in the list set forth in paragraph 25.108 of the Federal Acquisition Regulation.

17. **NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990).** Any delivery order awarded as a result of this solicitation will be a DO rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation. (based on FAR 52.212-7)

18. **DAILY WORK SCHEDULES.** In order to closely coordinate work under this contract, the Contractor shall prepare for and attend a weekly coordination meeting with the Contracting Officer and Using Service at which time the Contractor shall submit for coordination and approval, his proposed daily work schedule for the next two week period. Required temporary utility services, time and duration of interruptions, and protection of adjoining areas shall be included with the Contractor's proposed 2-week work schedule. At this meeting, the Contractor shall also submit his schedule of proposed dates and times of all preparatory inspections to be performed during the next 2 weeks. Coordination action by the Contracting Officer relative to these schedules will be accomplished during these weekly meetings.

19. **EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE.**

19.1. Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a Contractor or subcontractor at any tier shall be based on actual cost data when the Government can determine both ownership and operating costs for each piece of equipment or equipment groups of similar serial and series from the Contractor's accounting records. When both ownership and operating costs cannot be determined from the

Contractor's accounting records, equipment costs shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," S/N 008-022-0258-8, Vol. 5, Region V. Copies of each regional schedule may be obtained from the U.S. Government Printing Office (202-783-3238) at a cost of \$13.00 per schedule. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the Schedule in effect at the time of negotiations shall apply. For retrospective pricing, the Schedule in effect at the time the work was performed shall apply.

19.2. Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36, substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease-purchase, or sale-leaseback arrangements will be determined using the schedule except that rental costs leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees are allowable. Costs for major repairs and overhaul are unallowable.

19.3. When actual equipment costs are proposed and the total amount of the pricing action is over \$25,000, cost or pricing data shall be submitted on Standard Form 1411, "Contract Pricing Proposal Cover Sheet." By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorizing representative the right to examine those books, records, documents, and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement, the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete, and current. (EFARS 31.105)

20. **AS-BUILT DRAWINGS.** The Contractor shall maintain two separate sets of red-lined full scale, as-built construction drawings marked-up to fully indicate as-built conditions. In addition to the marked-up delivery order drawings, these drawings shall include the as-built shop drawings of all systems designed or enhanced by the contractor. These drawings shall be maintained in a current condition at all times until completion of the work and shall be available for review by Government personnel at all times. The location as dimensioned from permanent features, general description, type of material, and approximate depth below finished grade of all new and existing exterior underground utilities encountered shall be indicated. All interior conduit runs shall be indicated as being installed either overhead or underslab. All variations from the delivery order drawings for the required coordination between trades, shall be indicated. These variations shall be shown in the same general detail utilized in the initial delivery order drawings. Both sets of as-built construction drawings shall be furnished to the Contracting Officer on the date of final inspection. The submittal requirement for as-built construction drawings shall be shown as a separate activity on the Contractor prepared progress bar chart or network analysis system, whichever is applicable.

21. **NOT USED.**

22. GOVERNMENT-FURNISHED PROPERTY. Pursuant to "Government-Furnished Property (Short-Form)" the Government will furnish to the Contractor the following property to be incorporated or installed in the work. Such property will be furnished f.o.b. truck at the project site and the Contractor shall pick-up the property at a location designated by the Contracting Officer and transport the property to the jobsite at his own expense. All such property will be installed or incorporated into the work at the expense of the Contractor. The Contractor shall verify the quantity and condition of such Government-furnished property when delivered to him, acknowledge receipt thereof in writing to the Contracting Officer, and in case of damage to or shortage of such property, shall within 24 hours report in writing such damage or shortage to the Contracting Officer.

<u>Quantity</u>	<u>Item</u>	<u>Description</u>
Approx. 850	1	55-Gallon Poly Drum

23. NOT USED.

24. CONTRACTOR FURNISHED EQUIPMENT DATA. At or before 30 days prior to final inspection and acceptance of the work, the Contractor shall submit the data mentioned in the following subclauses.

24.1. EQUIPMENT LIST. An itemized equipment list showing unit retail value and nameplate data including serial number, model number, size, manufacturer, etc., for all Contractor-furnished items of mechanical equipment, electrical equipment, and fire protection systems installed under this delivery order.

24.2. GUARANTEES. A list of all equipment items which are specified to be guaranteed accompanied by a copy of each specific guarantee therefor. For each specific guaranteed item the name, address, and telephone number shall be shown on the list for subcontractor who installed equipment, equipment supplier or distributor, and equipment manufacturer. Completion date of the guarantee period shall correspond to the applicable specification requirements for each guaranteed item.

25. NOT USED.

26. NOT USED.

27. PROGRESS CHARTS submitted in accordance with the "Schedule for Construction Contracts" shall indicate the required data for each of the principal features of the work.

28. TIME EXTENSIONS. Notwithstanding any other provisions of this delivery order, the time extensions for changes in the work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the delivery order completion date will be extended only for those specific elements so delayed and that the remaining delivery order completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages pursuant to the new completion schedule. (based on FAR 52.212-6)

29. PERFORMANCE EVALUATION OF CONTRACTOR. The Contractor's performance will be evaluated upon final acceptance of the work. However, interim evaluation may be

prepared at any time during delivery order performance when determined to be in the best interest of the Government. The format for the evaluation will be SF 1420, and the Contractor will be rated either outstanding, satisfactory, or unsatisfactory in the areas of Contractor Quality Control, Timely Performance, Effectiveness of Management, Compliance with Labor Standards, and Compliance with Safety Standards. The Contractor will be advised of any unsatisfactory rating, either in an individual element or in the overall rating, prior to completing the evaluation, and all Contractor comments will be made a part of the official record. The final report will be supplemented or amended as necessary through the warranty period of the delivery order to reflect changes in the evaluation of performance elements based on compliance with warranty requirements. Performance Evaluation Reports will be available to all DOD Contracting offices for their future use in determining Contractor responsibility, in compliance with DFARS 236.201(c)(1). (based on EFARS 36.201 AND DFARS 236.201.

30. PERFORMANCE OF WORK BY CONTRACTOR (1984 APR). The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty (20) percent of the total amount of work to be performed under the delivery order. This percentage may be reduced by a supplemental agreement to this delivery order if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government. (FAR 52.236-1)

31. NOT USED.

32. NOT USED.

33. NOT USED.

34. NOT USED.

35. NOT USED.

36. OVERHEAD. Overhead is defined as all overhead costs other than extended overhead costs. Examples include but are not limited to general and administrative home office costs and non-time related field office costs. The percentage for overhead inserted in the Bidding Schedule shall be used in determining the amount to be applied to all change orders or modifications. Further, the stated percentage, when applied to direct costs, represents the total amount of overhead payable including any and all subcontractors. The percentage used in Item No. 3 of the Bidding Schedule is for evaluation purposes only and shall not be construed as a limitation or a guarantee of the amount of change orders or modifications that may be issued under the contract.

37. APPLICABILITY OF DAVIS-BACON ACT. It is the position of the Department of Defense that the Davis-Bacon Act, 40 U.S.C. 276a is applicable to temporary facilities such as batch plants, sandpits, rock quarries, and similar operations, located off the immediate site of the construction but set up exclusively to furnish required materials for a construction project on the site of the work. Clause "Payrolls and Basic Records" of the CONTRACT CLAUSES is applicable to such operations.

38. NOT USED.

39. PRE-PERFORMANCE/PRE-WORK CONFERENCE. Following the Award of the delivery order, the Contractor shall meet with the Contracting Officer or his representative for a Pre Performance Conference. The purpose of this conference is to review the organization, function and responsibilities of the Area office, authority of the Contracting Officer and field representatives, As-Built drawing requirements, Contractor supervision of work, Contractor quality control, labor classification and wage rates, salvaged materials, claims and modification procedures, Operation and Maintenance (O&M) requirements, expediting assistance, submittals, safety, environmental protection, progress schedules, and payment and procurement of materials. The principal features of the work will also be reviewed and any questions regarding the delivery order and work site shall be addressed. Attendance by the Contractor's superintendent, quality control personnel, safety personnel, and any major subcontractor's superintendents shall be required.

40. PROJECT RECORD DOCUMENTS. The Contractor shall maintain at the site for the Contracting Officer, one record copy of each and every document created by, obtained or received by the Contractor relating to the performance of work under this delivery order. The record copy is in addition to reports and data required to be submitted to the government under other provisions of the delivery order. Each copy of a project record document shall be legible and suitable for microfilm. Project record documents include information which is stored on computer, microfilm, paper, or any other form of information storage.

40.1 At the completion of the work under the delivery order, the Contractor shall organize the record copy of the project record documents in accordance with directions provided by the Contracting Officer, and shall deliver one complete set of the project record documents to the Contracting Officer, along with and index identifying all included documents.

40.2 All documents created by, obtained or received by the contractor in relation to the performance of work under this delivery order may contain privileged information of the United States. The Contractor shall not provide any copies of any project record documents to anyone except officers, employees, or agents of the United States until after notice to and in accordance with the directions of the Contracting Officer. If the Contractor desires to provide any copies of any project record documents to any other person, or if the Contractor is required or directed to provide any copies of any project record documents to any other person, the Contractor shall immediately notify the Contracting Officer, who shall identify to the Contractor all privileged information of the United States. The Contractor shall not release outside of the United States Government or its own office any documents which contain any information which has been identified as privileged by the Contracting Officer.

40.3 The cost of complying with the requirements of this section shall be included in the delivery order price. The cost of releasing any nonprivileged documents outside of the Government shall not be borne by the Government, unless the release is directed by the Contracting Officer.

41. PROJECT PHOTOGRAPHS. The Contractor shall furnish photographs, taken by an experienced photographer using suitable equipment, to record the important features of the site prior to the commencement of work, during delivery order performance, and after the work has been completed. The actual number and

location of views to be taken shall be as directed by the Contracting Officer; however, it is anticipated that 100 to 150 project photographs shall be required. All photographs are the property of the United States Government and shall not be released by the Contractor to anyone except officers, employees or agents of the United States until after notice to and in accordance with the directions of the Contracting Officers.

41.1. SUBMITTAL OF PRINTS. The Contractor shall submit two (2) color prints (3 inch by 5 inch) of standard commercial quality, single-weight glossy paper, along with the negatives to the Contracting Officer within ten (10) days of taking the photographs or as directed by the Contracting Officer.

41.2. LABELING OF PRINTS. The photographs shall be labeled with the project number, contract number, designer, contractor, photograph number, date and description.

41.3. VIEWS REQUIRED. The photographs shall illustrate the condition and location of the work and the state of progress. Before work begins the Contractor shall take exposures including views of the general site showing the location of each facility, access road(s), etc. Progress photographs, after commencement of work shall record installation of the equipment, cutting of tank access, sludge removal and drum loading, truck loading and unloading, cutting and removal of the tank liner and geonet, employee decontamination, decontamination of the tank appurtenances, and any unanticipated events such as spillage of drum contents or related accidents. After completion of work the Contractor shall take exposures including views of the decontaminated tank and areas previously photographed prior to start of work. The Contractor shall consult with the Contracting Officer at each period of photography for recommendations concerning views required.

June 1990

ZERO ACCIDENTS

SECTION 01200
WARRANTY OF CONSTRUCTION

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1. WARRANTY OF CONSTRUCTION (APR 1984).

1.1. In addition to any other warranties in this delivery order, the Contractor warrants, except as provided in paragraph 1.10 below, that work performed under this delivery order conforms to the delivery order requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.

1.2. This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.

1.3. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of--

1.3.1. The Contractor's failure to conform to delivery order requirements; or

1.3.2. Any defect of equipment, material, workmanship, or design furnished.

1.4. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.

1.5. The Contracting Officer shall notify the Contractor, in writing, (by telephone in the case of WARRANTY SERVICE CALLS), within a reasonable time after the discovery of any failure, defect, or damage.

1.6. If the Contractor fails to remedy any failure, defect, or damage within a time as specified in paragraph: WARRANTY SERVICE CALLS after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

1.7. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this delivery order, the Contractor shall--

1.7.1. Obtain all warranties that would be given in normal commercial practice;

1.7.2. Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer, and

1.7.3. Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.

1.8. In the event the Contractor's warranty under paragraph 1.2 above has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.

1.9. Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government furnished material or design.

1.10. This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this delivery order with respect to latent defects, gross mistakes, or fraud.

1.11. Defects in design or manufacture of equipment specified by the Government on a "brand name and model" basis, shall not be included in this warranty. In this event, the Contractor shall require any subcontractors, manufacturers, or suppliers thereof to execute their warranties, in writing, directly to the Government. (Based on FAR 52.246-21)

2. **SUBMITTALS.** Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 - SUBMITTAL DESCRIPTIONS.

2.1. **SD-01 Data. F.I.O.** Provide names of service representatives that will make warranty calls along with the day, night, weekend and holiday contacts for response to a call within the time period specified.

3. **WARRANTY SERVICE CALLS.** The Contractor shall furnish to the Contracting Officer the names of local service representatives and/or Contractors that are available for warranty service calls and who will respond to a call within the time periods as follows: 4 hours for heating, air-conditioning, refrigeration, air supply and distribution, and critical electrical service systems, and 24 hours for all other systems. The names, addresses, and telephone numbers for day, night, weekend, and holiday service responses shall be furnished to the Contracting Officer and also posted at a conspicuous location in each mechanical and electrical room or close to the unit.

ZERO ACCIDENTS

SECTION 01300

SUBMITTAL DESCRIPTIONS

03/91

1. GENERAL.

1.1. SUBMITTALS. The submittals described below are those required and further described in other sections of the specifications. Other requirements pertaining to submittals are included in the SPECIAL CLAUSES and Section 01305 SUBMITTAL PROCEDURES. Other nontechnical parts of the delivery order are not included in this section.

SD-01 Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

SD-04 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

SD-06 Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-07 Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

SD-08 Statements

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

SD-09 Reports

Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

SD-13 Certificates

Statement signed by responsible official of a manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this delivery order, must name the project, and must list the specific requirements which are being certified.

SD-14 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-18 Records

Documentation to record compliance with technical or administrative requirements.

SD-19 Operation and Maintenance Manuals

Data which forms a part of an operation and maintenance manual.

SECTION 01305
SUBMITTAL PROCEDURES

INDEX

ATTACHMENTS:

Submittal Register (ENG Form 4288)
Transmittal Form (ENG Form 4025)

1. GENERAL

- 1.1. SUMMARY (Not Applicable)
- 1.2. REFERENCES (Not Applicable)
- 1.3. RESPONSIBILITIES

1.3.1. **Contractor Responsibilities.** The Contractor is responsible for total management of his work including scheduling, control, and certification of all submittals. The submittal management system provided in these specifications is intended to be a complete system for the Contractor to use to control the quality of materials, equipment and workmanship provided by manufacturers, fabricators, suppliers and subcontractors. The Contractor shall review each submittal for contract compliance. Submittals that comply will be forwarded to the Government. Submittals that do not conform will be returned to the originator to be corrected. The Submittal Register (ENG Form 4288) will be utilized to log and monitor all submittal activities. No construction or installation activities shall be performed prior to required approvals of applicable submittals. The Contractor shall perform a check to assure that all materials and/or equipment have been tested, submitted and approved during the preparatory phase of quality control inspections.

1.3.2. **Government Responsibilities.** The Government will prepare a list of submittals required for each contract. This list will be prepared ENG Form 4288 (Submittal Register) and will be limited to columns "c" through "o". The Government will review submittals designated for Government approval and approve those that conform to contract requirements. The approval of submittals by the Contracting Officer shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the CQC requirements of this contract is responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be given consideration unless accompanied by justification as to why a substitution is necessary.

1.4. **SUBMITTAL CLASSIFICATION.** Submittals are classified as follows:

1.4.1. **Government Approved.** Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings." See paragraph: CATEGORIES OF SUBMITTALS below.

1.4.2. **Information Only.** All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above. See paragraph: CATEGORIES OF SUBMITTALS below.

1.5. **CATEGORIES OF SUBMITTALS**

1.5.1. **Category I.** All Category I submittals are subject to Government approval. Category I submittals may also be noted as "GA1" in the technical specifications and Submittal Register.

1.5.2. **Category II.** Category II submittals may be required for "Government Approval" or "For Information Only." Within the terms of the CONTRACT CLAUSES clause entitled "Specifications and Drawings for Construction,"

Category II submittals for "Government Approval" are considered to be "shop drawings" and Category II submittals "for information only" are not considered to be "shop drawings." Category II submittals for Government approval are noted as "GA2" or "For Approval" in the technical specifications and Submittal Register. Category II submittals for information only are noted as "FIO" or "For Information Only" in the technical specifications and Submittal Register.

1.6. **DISAPPROVED SUBMITTALS.** The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies as specified for the initial submittal. The Contractor shall examine his quality control plan and organization to determine why his controls did not identify the deficiency. Appropriate adjustments will be made in the quality control program and/or implementation. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, notice as required under the Contract Clause entitled "Changes" shall be given promptly to the Contracting Officer.

1.7. **WITHHOLDING OF PAYMENT.** Payment for materials incorporated in the work will not be made if required submittals/approvals have not been obtained.

2. PRODUCTS (Not Applicable)

3. EXECUTION

3.1. **GENERAL.** The Contractor shall submit all items listed on the Submittal Register (ENG Form 4288) or specified in the other sections of these specifications. The Contracting Officer may request submittals in addition to those listed when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same used in the contract drawings. Submittals shall be made in the respective number of copies and to the respective addresses set forth below. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with all contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) representative and each respective transmittal form (ENG Form 4025) shall be stamped, signed, and dated by the CQC representative certifying that the accompanying submittal complies with all the contract requirements. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals including parts list; certifications; warranties and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby.

3.2. **SUBMITTAL REGISTER (ENG Form 4288).** The Contractor will be furnished one (1) set of ENG Forms 4288 at the preconstruction conference on which will be listed each item of equipment and material of each type for which fabricators drawings, and/or related descriptive data, test reports, samples, spare parts lists, O&M manuals, or other types of submittals are required by the specifications. An advance copy of the ENG Form 4288 may be obtained by written request to CEMRO-ED-DI, 215 N. 17th Street, Omaha, NE 68102-4978. Columns "c" thru "o" have been completed by the Government. The Contractor shall complete columns "a," and "p" thru "r" and return Six (6) completed copies to the Contracting Officer for approval within twenty (20) calendar days after the preconstruction conference.

The ENG Forms 4288 will become a part of the contract after approval. [Six (6) additional copies of a revised ENG Form 4288 with column a, NAS ACTIVITY CODE, filled in shall be submitted with the completed network analysis system when a network analysis system is a contract requirement.] Column b shall be left blank for use later to record the respective transmittal and item number corresponding to those listed on the transmittal form entitled: "TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE" (ENG Form 4025). The approved submittal register will become the

scheduling document and will be used to control submittals throughout the life of the contract. This register and the progress schedules shall be coordinated.

3.3. **SCHEDULING.** Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of twenty (20) calendar days exclusive of mailing time) shall be allowed on the register for review and approval. No delays damages or time extensions will be allowed for time lost in late submittals. [An additional 20 calendar days shall be allowed and shown on the register for review and approval of submittals for food service equipment [and submittals for refrigeration and HVAC control systems.]]

3.4. **TRANSMITTAL FORM (ENG Form 4025).** The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care will be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.5. **SUBMITTAL PROCEDURE.** Submittals shall be made as follows:

3.5.1. **Procedures**

3.5.1.1. **Category I Submittals.** All items listed as Category I submittals in the various sections or on the Submittal Register shall be mailed directly to the addressee shown below as directed. For each submittal, a completed information copy of the attached transmittal form shall also be mailed to the Area Engineer and to the Construction Division of the Omaha District.

An additional copy of Category I submittals related to fire protection/detection systems shall be submitted to the Base Civil Engineering Office. The mailing address for these submittals shall be obtained at the preconstruction conference.

Three (3) additional copies of Category I submittals related to fire protection/detection systems shall be submitted as follows:

Two (2) copies to: HQ USAFA/DEER

One (1) copy to: AFRCE-CR

The mailing address for these submittals shall be obtained from the Contracting Officers Representative at the preconstruction conference.

Technical Reviewer

Engineering Division
Attn: CEMRO-ED-DI
U.S. Army Engineer District, Omaha
215 North 17th Street
Omaha, NE 68102-4978

Mailing address of Architect-Engineer Firm

Each required submittal which is in the form of a drawing shall be submitted as one (1) reproducible and one (1) print of the drawing. Drawing prints shall be either blue or black line permanent-type prints on a white background or blueprint. Reproducibles shall be brownline diazo or sepia and shall be of such quality that prints made therefrom are sufficiently clear for microfilm copying.

All catalog and descriptive data shall be submitted in nine (9) copies. Catalog cuts and other descriptive data which have more than one model, size, or type or which shows optional equipment shall be clearly marked to show the model, size, or type and all optional equipment which is proposed for approval. Submittals on component items forming a system or that are interrelated shall be submitted at one time as a single submittal in order to demonstrate that the items have been properly coordinated and will function as a unit.

3.5.1.2. **Category II Submittals.** Except as noted below, data for all items listed as Category II Submittals in the various sections shall

be submitted in five (5) six (6) copies to the Area Engineer using the transmittal form. Items not to be submitted in multiples, such as samples and test cylinders, shall be submitted to the Area Engineer Resident Engineer Project Engineer Lake Manager accompanied by five (5) copies of the transmittal form.

3.5.1.3. Certificates of Compliance. Each certificate shall be signed by an official authorized to certify in behalf of the manufacturing company and shall contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Contractor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

3.5.1.4. Purchase Orders. Copies of purchase orders shall be furnished to the Contracting Officer when the Contractor requests assistance for expediting deliveries of equipment or materials, or when requested by the Contracting Officer for the purpose of quality assurance review. Each purchase order issued by the Contractor or his subcontractors for materials and equipment to be incorporated into the project shall (1) be clearly identified with the applicable DA contract number, (2) carry an identifying number, (3) be in sufficient detail to identify the material being purchased, (4) indicate a definite delivery date, and (5) display the DMS priority rating, if applicable.

3.5.1.5. Equipment Room Drawings. The Contractor shall prepare and submit room plans for all mechanical, electrical, and communication rooms or similar areas.

a. Assembled Submittal. Submittals describing the various mechanical and electrical equipment items which are to be installed in the above described area(s) shall be assembled and submitted under Category I concurrently and accompanied by the room plans.

b. Scaled Details. Plans, consolidated for all trades shall be to scale and shall show all pertinent structural features and other items such as doors, windows, and cabinets required for installation and which will affect the available space. All mechanical and electrical equipment and accessories shall be shown to scale in plan and elevation and/or section in their installed positions. All duct work and piping shall be shown.

3.5.1.6. Operation and Maintenance Instructions and/or Manuals. Where required by various technical sections, operations and maintenance instructions and/or manuals with parts lists included shall be provided by the Contractor in quintuplicate, unless otherwise specified, and shall be assembled in three-ring binders with index and tabbed section divider and having a cover indicating the contents by equipment or system name and project title and shall be submitted for approval to the Contracting Officer 30 days prior to final tests of mechanical and electrical systems. Each operation and maintenance manual shall contain a copy of all warranties and a list of local service representatives required by SECTION: WARRANTY OF CONSTRUCTION. If field testing requires these copies to be revised, they shall be updated and resubmitted for approval within 10 calendar days after completion of tests. The Operations and Maintenance Instructions and/or Manuals shall be shown as a separate activity on the Contractor prepared construction schedule bar chart or network analysis system. In addition one reproducible unfolded copy of all wiring and control diagrams and approved system layout drawings shall be submitted with the O&M Manuals. See SECTION: FACILITY OPERATION AND MAINTENANCE MANUAL for additional requirements.

3.5.2. Deviations. For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6. CONTROL OF SUBMITTALS. The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or

before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7. **GOVERNMENT APPROVED SUBMITTALS.** Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated.

3.7.1. **Category I.** The drawing print and six (6) sets of all catalog data and descriptive literature will be retained by the Contracting Officer and the drawing reproducible and two (2) sets of catalog data and descriptive literature will be returned to the Contractor.

3.7.2. **Category II.** Two (2) copies of Category II submittals for approval will be returned to the Contractor except for samples, test cylinders, and O&M manuals for which two (2) copies of the transmittal form only will be returned to the Contractor.

3.8. **INFORMATION ONLY SUBMITTALS.** "Information Only" submittals are noted in the specifications and Submittal Register. In the technical specifications, these submittals will be marked as "FIO" or "For Information Only". Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. These submittals will be used for information purposes. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications and will not prevent the Contracting Officer from requiring removal and replacement if nonconforming material is incorporated in the work. This does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

3.9. **STAMPS.** Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR	
(Firm Name)	
_____	Approved
_____	Approved with corrections as noted on submittal data and/or attached sheets(s).
SIGNATURE: _____	
TITLE: _____	
DATE: _____	

-- End of Section --

**INSTRUCTIONS
ENG FORM 4288**

1. Column a, will be provided by the Contractor from his Network Analysis, if required, and when a network analysis is accepted.
 2. Column b, will be provided by the Contractor from Eng Form 4025 for each item. Transmittal number and Item number will be the same on both forms.
 3. Column c, will be provided by the government to the Contractor.
 4. Column d thru n, will be provided by the government to the Contractor.
 5. Column o, will be provided by the government to the Contractor. Abbreviation code will be as follows;

GA1 - Government Approved Category I.
GA2 - Government Approved Category II.
FIO - For Information Only.
 6. Column p, will be provided by the Contractor. It will be the scheduled date the Contractor expects to submit an item. It is the Contractors responsibility to calculate the lead time needed for the government approval. Note if resubmittal is required it is the Contractors responsibility to make all adjustments necessary to meet the contract completion date.
 7. Column q, will be provided by the Contractor. It will be the latest date the Contractor can receive a approval and still obtain the material by need date.
 8. Column r, will be provided by the Contractor. It will be the date that the material is needed at the site. If there is a network analysis it should reflect that date on the analysis.
 9. Column s, will be provided by the Contractor. The code will contain the action code used on Eng Form 4025, column g, for each item submitted to the government.
 10. Column t, will be provided by the Contractor. The date will be the same as shown at the top of corresponding Eng Form 4025 and will reflect the date the actions shown in column s were rendered.
 11. Column u, delete.
 12. Column v, will be provided by the government. The code will contain the action code used on Eng Form 4025 column i, for each item submitted to the government.
 13. Column w, will be provided by the government. The date when the actions listed in column v were taken will be entered. The date will be the same as shown in Eng Form 4025, Section II.
 14. Column x, self explained.
- Any revisions to the submittal register shall be submitted for approval by the Contractor as soon as possible.

**INSTRUCTIONS
ENG FORM 4025**

1. DATE at the top of form will be the date submitted to the government which is to be completed by the Contractor.
2. TRANSMITTAL NO. Each new transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number in addition to the item number will form the submittal number for identifying each submittal. For new submittal or resubmittal mark the appropriate box. Transmittal number for resubmittal will contain an alphabet letter following original transmittal number (i.g. resubmittal of Transmittal Number 5 will be Transmittal Number 5a).
3. TO: box will contain the name and address of the office which will review the submittal. The name and address should be given in paragraph 3.5. Contractor is to complete this box after reviewing the classification provided by the government on Eng Form 4288 column o and determining the proper address.
4. FROM: box will be the name and address of the Contractor. Contractor is to complete this box.
5. CONTRACT NO. box will contain the Contractor's construction contract number (e.g. DACXXX-XX-C-XXXX).
6. CHECK ONE box will be completed by the Contractor with one box marked. If a resubmittal is provided last transmittal number will be added.
7. SPECIFICATION SECTION NO. box will be completed by the Contractor. The number will be the six digit number found in the specifications. No more than one section will be covered with each transmittal.
8. PROJECT TITLE AND LOCATION box will be completed by the Contractor.
9. Column a, will be completed by the Contractor and will contain a different number for each item submitted in that transmittal. Once a number is assigned to an item it will remain the same even if there is a resubmittal.
10. Column b, will be completed by the Contractor. The description of each item on this form will include the descriptions provided by the government on the submittal register Eng Form 4288 column d thru n plus any other data necessary to describe the item. The Contractor shall submit each submittal register item all at once on one transmittal if possible. If a submittal register item can not be submitted all at once Contractor should not put that in the remarks box. If a submittal register item requires several items, description shall contain submittal register description plus any additional specific descriptions. Additional items not on the submittal register will be noted in the remarks box.
11. Column c, will be completed by the Contractor. The information will be the appropriate submittal description number as described in Section 1300 or shown on submittal register Eng Form 4288 column d thru n (e.g. SD-XX).
12. Column d, will be completed by the Contractor. The number of copies will be determined by the Contractor after review of Eng Form 4288, column o, for the classification of the item and after review of paragraph 3.5 of Section 1305 "Submittal Procedures".
13. Column e, will be completed by the Contractor. The Contractor shall state all applicable paragraph numbers.
14. Column f, will be completed by the Contractor. The Contractor shall state all applicable drawing sheet numbers.

15. Column g, will be completed by the Contractor. The action codes will be one of the following when submittal is for the government:

- A - Approved as submitted.
- B - Approved, except as noted.
- C - Approved, except as noted. Refer to attached sheet resubmission required.
- G - Other (specify).

16. Column h, will be completed by the Contractor. A check shall be placed in this column when a submittal is not in accordance with the plans and specifications also, a written statement to that effect shall be included in the space provided for "Remarks".

17. Column i, will be completed by the government. The action code will be one of the following;

- A - Approved as submitted.
- B - Approved except as noted on drawings.
- C - Approved, except as noted on drawings. Refer to attached _____ sheet resubmission required.
- D - Will be returned by separate correspondence.
- E - Disapproved (See Attached).
- Fx - Receipt acknowledged, does not comply as noted with contract requirements.
- G - Other (specify).

18. REMARKS box self explained.

19. Contractor must sign all Eng Form 4025 certifying conformance.

20. Section II will be completed by the Government. Contractor is not to write in this space.

See reverse side of ENG Form 4025 for additional instructions.

DATE _____

(Read instructions on the reverse side prior to initiating this form)

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (This section will be initiated by the contractor)

TO:	FROM:	CONTRACT NO.	CHECK ONE: <input type="checkbox"/> THIS IS A NEW TRANSMITTAL <input type="checkbox"/> THIS IS A RESUBMITTAL OF TRANSMITTAL _____
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[illegible]

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (List by Item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

ZERO ACCIDENTS

SECTION 01401

SAFETY, HEALTH AND EMERGENCY RESPONSE

INDEX

- 1. INSTRUCTIONS**
- 2. REFERENCES**
- 3. CONTRACTOR'S WRITTEN HEALTH AND SAFETY PROGRAM**
- 4. SITE-SPECIFIC SAFETY AND HEALTH PLAN (SSHP)**

ATTACHMENTS

Table A-1 - Chemical Characterization of Basin F Liquid

Table B-1 - Exposure Limits and Properties of Compounds Detected in Basin F Liquids

1. INSTRUCTIONS.

1.1. USE OF THESE SPECIFICATIONS. The following specifications are intended to define minimum acceptable considerations for the development of a site-specific safety and health program for use during Basin F liquid storage tank decontamination. The use of this guidance document for the generation of a site-specific safety plan is not intended to limit or specify particular measures that may be taken to protect workers at this site, nor to relieve site and project management of worker safety responsibilities.

1.2. JUSTIFICATION OF OMISSIONS. All items in this specification shall be addressed. If any items are determined to not be required, they shall still be listed with an explanation as to why the topic or item is not addressed in the plan.

1.3. MODIFICATIONS. Review comments provided by the contracting officer (CO) prior to approval of the site-specific safety and health plan shall be incorporated by revising and reissuing affected pages. If major revisions are necessary, the entire plan shall be resubmitted. Minor changes affecting only a few pages may be made by addenda sheets.

2. REFERENCES.

2.1. EM 385-1-1, US Army Corps of Engineers Safety and Health Requirements Manual, dated April 1981, Revised Oct 1987.

2.2. 29 Code of Federal Regulations Part 1910, Occupational Safety and Health Standards.

2.3. ANSI B15.1, Safety Standards for Mechanical Power Transmission Apparatus

2.4. 29 CFR 1926, Health and Safety Regulations For Construction.

2.5. Department of Health and Human Services (National Institute of Occupational Safety and Health) Publication Number 85-115, "Occupational Safety and Health Guidance Manual for Hazardous Site Activities," October 1985.

2.6. Latest edition of "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices," American Conference of Governmental Industrial Hygienists.

3. CONTRACTOR'S WRITTEN SAFETY AND HEALTH PROGRAM. A written safety and health program for employees engaged in hazardous waste operations shall be developed and implemented, as required by 29 CFR 1910.120 (b). The written safety and health program shall be made available to any subcontractor or subcontractor representative who shall be involved with the hazardous waste operation; to employees or their designated representatives; to representatives of the Occupational Safety and Health Administration (OSHA); and to personnel of federal, state or local agencies with regulatory authority over the site.

4. SITE-SPECIFIC SAFETY AND HEALTH PLAN (SSHP). A site-specific safety and health plan shall be prepared and shall address the safety and health hazards of

each phase of site operation. The SSHP shall be prepared in accordance with 29 CFR 1910.120 (b)(4). The site manager and the site safety and health officer shall both maintain a copy of the site-specific safety and health plan on site. In addition a copy of the SSHP shall be provided to all contractors and subcontractors working on-site. On-site workers shall be briefed on the contents of the SSHP. Following the briefing, workers shall sign a statement that they have received the briefing, understand the contents of the SSHP, and agree to abide by provisions of the SSHP.

4.1. PROJECT IDENTIFICATION. The project shall be clearly identified. The following information shall be included as a minimum.

- 4.1.1. Corps of Engineers district and district address
- 4.1.2. Contract Number
- 4.1.3. Delivery Order Number
- 4.1.4. Contract Modification Number (if one exists)
- 4.1.5. Contract title
- 4.1.6. Contractor's project number

4.2. SITE INFORMATION AND CONTAMINANT CHARACTERIZATION. The location, approximate size of the site, site topography, and a site map shall be included. Information obtained during previous environmental sampling at the site shall be presented here. The contaminant characterization shall include the hazardous materials previously detected on site, the range of concentrations of the contaminants found, locations on site, the estimated quantities/volumes to be impacted by site work, and the environmental media in which the contaminants were found. Information which may assist in the preparation of this section is presented in Attachment A.

4.3. WORK ACTIVITIES. A listing shall be included of all tasks to be accomplished during hazardous waste operations covered by 29 CFR 1910.120(a)(1) and (2). As a minimum, the activities discussed in Attachment B shall be included.

4.4. HAZARD ASSESSMENT/HAZARD ANALYSIS. Information specified in Sections 4.2 and 4.3 above shall be used to formulate a task by task hazard assessment to be included in this Section. Attachment B contains information which shall be used in preparing this section.

Chemical and physical (including safety) hazards of concern for each site task and/or operation to be performed shall be identified. A description of the routes and sources of exposures, anticipated on and off-site exposure level potentials and regulatory (including Federal, State and local) or recommended protective exposure standards shall be included.

At a minimum, the hazard assessment must evaluate the potential for exposure to ammonia, 4-chlorophenyl methyl sulfoxide, dimethyldisulfide, diisopropyl methylphosphonate, dimethyl methylphosphonate as discussed in Attachments A and B. Physical hazards to be addressed include, but are not limited to: electrical hazards; welding hazards; heat and cold stress; uneven ground; slips, trips and falls; sensory and dexterity limitations resulting from wearing PPE; noise; confined space entry; and hazards involved with the use of heavy equipment, cranes, and personnel hoists.

4.5. ACCIDENT PREVENTION. All requirements of Section 01.A and Appendix Y of USACE EM 385-1-1 which describes preparation of an Accident Prevention Plan shall be fulfilled as part of the safety and health plan.

Procedures shall be developed that incorporate the reporting criteria and requirements established by USACE EM 385-1-1, Section 2.

4.6. STAFF ORGANIZATION, RESPONSIBILITIES, AUTHORITIES. The names of personnel to serve as the site manager and the site safety and health officer, and alternates, shall be included as a minimum. Names shall also be applied to the following positions; rescue team members, decontamination station officer, and field team leader(s).

A Certified Industrial Hygienist (CIH) with experience in the hazardous waste remediation industry shall sign and date the SSHP prior to submittal. The CIH shall visit the site at least once during field operations to audit compliance with the health and safety plan. In addition, the CIH shall maintain health and safety oversight for the duration of the project. A fully trained and experienced Site Safety and Health Officer (SSHO), responsible to the CIH, shall

be delegated to implement and continually enforce safety and health on site. The SSSH shall insure conformance with the provisions of the SSHP, and shall provide the pre-entry and weekly safety briefings for all personnel. Air monitoring and sampling as required by the SSHP shall be performed by the SSSH. The SSSH shall have the authority to stop field activities if the health and safety of personnel is endangered.

4.7. TRAINING.

4.7.1. General. All employees on the site with the potential for exposure to hazardous materials and health hazards shall have completed minimum training requirements specified in 29 CFR 1910.120 (e). This includes requirements for an initial 40-hours of training off-site followed by 3 days of supervised field experience. No person shall fulfill these requirements through the "grandfather clause" described in 29 CFR 1910.120 (e)(9).

Employees shall have completed either the initial 40 hour training or 8 hours of refresher training within the last 12 months. All supervisory personnel shall have completed an additional 8 hours of training required for management of personnel and activities associated with hazardous waste work. In addition to requirements established by 29 CFR 1910.120(e), at least 2 employees on each shift shall be qualified to administer first aid and CPR as specified in EM 385-1-1. Section 04.A.02. Minimum qualifications are described in EM 385-1-1, section 04.E. Procedure shall be established to insure that verification of safety and health training completion is maintained on-site. The type (initial, supervisory refresher and site-specific) duration and dates of all employee training performed shall be listed by employee name and certified in the SSHP.

4.7.2. Site-Specific Briefing.

4.7.2.1. Site-specific briefings shall be conducted by the SSSH prior to commencement of work on site. All site employees shall be required to attend the briefing. Employees who are new to the site after work has commenced shall be given this briefing prior to entering a Contamination Reduction Zone or Exclusion Zone. Elements to be covered during this training include:

4.7.2.1.1. Names of personnel and alternates responsible for site safety and health;
4.7.2.1.2. Safety, health and other hazards present on the site;
4.7.2.1.3. Use of personal protective equipment;
4.7.2.1.4. Work practices by which the employees can minimize risks from hazards;
4.7.2.1.5. Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards; and
4.7.2.1.6. Procedures for engineering controls, site control, materials handling, decontamination, and emergency response and air monitoring.

4.7.2.2. Weekly safety and health briefings shall be held by the SSSH to discuss health and safety procedure modifications, air monitoring results, and new operations on site. In addition on-site training shall be provided as needed.

4.7.2.3. Confined Space Entry. The Contractor shall ensure that the CIH provides training for employees who are required to enter confined spaces. The Contractor shall write a confined space entry procedure and use an entry permit system according to the requirements of EM 385-1-1, Section 27. The written procedure shall be included in the SSHP that is submitted to the CO for review.

A confined space entry permit shall be developed for entry into the tank and shall be reviewed prior to the start of each shift. The permit shall be posted at all access points into the tank. The permit shall address the following: location of work description of work, employees assigned, entry date and time, isolation checklists, hazardous work, hazards expected, fire safety precautions, personnel safety, results of atmospheric tests performed, and person performing them, authorization and permit expiration time.

4.8. PERSONAL PROTECTIVE EQUIPMENT (PPE). A PPE equipment program that complies with 29 CFR 1910.120(g) shall be developed and implemented. The program shall also include the provisions for selecting and using PPE as required by 29 CFR 1910 Subpart I.

4.8.1. Definition of levels of protection. Site and task specific ensembles of PPE shall be defined. Minimum requirements for this site are given below. Upgrades and downgrades of PPE must be based on appropriate action levels (Section 4.10.3).

4.8.1.1. Level D shall consist of:

4.8.1.1.1. Disposable coveralls or work clothes

4.8.1.1.2. Chemical resistant steel-toed boots

or leather steel-toed boots with disposable, chemical resistant boot covers worn over them

4.8.1.1.3. Hard hat (shall be required when

overhead hazards exist)

4.8.1.1.4. Safety glasses with side shields

4.8.1.2. Modified Level D shall consist of:

4.8.1.2.1. Uncoated Tyvek or equivalent disposal

coverall

4.8.1.2.2. Saranex or equivalent disposable

coverall shall be substituted for Tyvek if splashing may occur (If the splash hazard is expected to be minimal, uncoated Tyvek with a splash apron may be worn.)

4.8.1.2.3. Nitrile outer gloves

4.8.1.2.4. Latex or nitrile inner gloves

4.8.1.2.5. Chemical resistant steel-toed boots

or leather steel-toed boots with disposable, chemical resistant boot covers worn over them

4.8.1.2.6. Tape (shall be used to seal the

joints between coveralls and protective gloves or boots)

4.8.1.2.7. Hard hat (shall be required when

overhead hazards exist)

4.8.1.2.8. Safety glasses with side shields

4.8.1.2.9. Splash resistant goggles or a face

shield (shall be worn if splash hazard exists)

4.8.1.3. Level B shall consist of:

4.8.1.3.1. Uncoated Tyvek or equivalent

disposable coverall excluding cotton coveralls

4.8.1.3.2. Saranex-coated outer coveralls with

hood taped to respirator

4.8.1.3.3. Nitrile outer gloves

4.8.1.3.4. Latex or nitrile inner gloves

4.8.1.3.5. Steel-toed chemical-resistant boots

4.8.1.3.6. Disposable chemical-resistant boot

covers

4.8.1.3.7. Tape (shall be used to seal the

joints between coveralls and protective gloves or boots)

4.8.1.3.8. Hard hat (shall be required when

overhead hazards exist)

4.8.1.3.9. Pressure-demand, full-facepiece,

self-contained breathing apparatus (SCBA) or full facepiece supplied air airline respirator with escape SCBA

4.8.1.3.10. Compressed air or cool pack cooling

units shall be provided as needed to prevent heat stress.

4.8.2. Minimum Levels of Protection. The following initial levels of protection shall be required for specified activities. These requirements establish only minimum protection levels. Actual field conditions and/or air monitoring may dictate upgrades and downgrades. Additional protective equipment may be required for a specific task based on site conditions.

TASK	INITIAL LEVEL OF PROTECTION
1. Site preparation and demobilization- not intrusive into tank or piping - no splash hazard or potential for exposure to contaminated materials	Level D
2. Site preparation and demobilization- not intrusive into tank or piping - potential for splash hazard or exposure to contaminated materials	Modified Level D
3. All monitoring activities during heating and recirculation	Modified Level D
4. All intrusive activities including intrusive site preparation, tank decontamination	Level B
5. Equipment decontamination	Level B

4.8.3. Respiratory protection program. The contractor shall have a written respiratory protection program as specified in 29 CFR 1910.134 and shall comply with requirements established by 29 CFR 1926.103. Requirements for this site shall include the following:

4.8.3.1. Written standard operating procedures governing the selection and use of respirators shall be established.

4.8.3.2. Respirators shall be selected on the basis of hazards to which the worker is exposed.

4.8.3.3. The user shall be instructed and trained in the proper use of respirators and their limitations.

4.8.3.4. Respirators shall be regularly cleaned and disinfected. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

4.8.3.5. Respirators shall be stored in a convenient, clean and sanitary location.

4.8.3.6. Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-contained devices shall be thoroughly inspected at least once a month and after each use.

4.8.3.7. Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.

4.8.3.8. There shall be regular inspection and evaluation to determine the continued effectiveness of the program.

4.8.3.9. Persons should not be assigned to tasks requiring respirators unless it has been determined that they are physically able to perform the work and use the equipment.

4.8.3.10. Only respirators with National Institute of Occupational Safety and Health and/or Mine Safety and Health Administration approvals shall be used at this site.

4.8.3.11. Eyeglasses with conventional temple pieces shall not be worn under full face piece respirators. Provisions shall be made for utilizing spectacle insert kits produced by the respirator manufacturer for the specific model respirator being employed.

4.8.4. **Hearing Protection.** Procedures shall be established that incorporate requirements specified in 29 CFR 1926.101. Hearing protection shall be required during this investigation for exposures of greater than 90 dBA for any length of time. In the absence of instrumentation, when normal conversation is difficult at a distance of greater than two or three feet, hearing protection shall be required. The contractor shall have hearing protection available on site at all times for their employees.

4.9. **MEDICAL SURVEILLANCE.** Details of the medical surveillance program applicable to employees working at the site shall be included here. The program shall be in compliance with 29 CFR 1910.120 (f) and ANSI Z88.2. The medical surveillance protocols shall be overseen by a licensed physician who is certified in Occupational Medicine by the American Board of Preventative Medicine or who is Board-eligible. The physician shall be given information on the expected contaminants and exposure potentials and may alter the surveillance program as required. Procedures shall be established to insure that the physicians written opinion and the results of respirator fit testing used to verify each employees suitability to work in hazardous waste shall be maintained on-site.

Due to the requirement for wearing self-contained breathing apparatus and the potential for exposure to a complicated matrix of contaminants, the following are minimum requirements for the medical surveillance program:

- 4.9.1. complete physical
- 4.9.2. pulmonary function test
- 4.9.3. CBC differential
- 4.9.4. SMAC 22, and
- 4.9.5. urinalysis.

Certification of participation in the medical surveillance program, the date of cost examination and name of reviewing occupational physician shall be included in the SSHP. The written medical opinion from the attending physician required by 1910.120(f)(7) shall be made available upon request to the CO for any site employee.

4.10. **EXPOSURE MONITORING/AIR SAMPLING PROGRAM.**

4.10.1. Personnel Monitoring Procedures shall be devised to insure exposure monitoring is accomplished as detailed in 29 CFR 1910.120 (h). Both direct reading (real-time) air monitoring and integrated (time-weighted average TWA) air sampling shall be employed. Direct reading instruments selected for use shall be listed and a discussion of the instruments sensitivity, selectivity, and interferences shall be included. National Institute of Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), or Environmental Protection Agency (EPA) sampling methodologies shall be used to conduct integrated sampling. Acceptable NIOSH, OSHA or EPA methodologies have not been developed for some compounds on this site. Methods developed specifically for the Rocky Mountain Arsenal (PMRA methods) shall be used in this case. Integrated samples considered to be representative of an employees exposure shall be analyzed by a laboratory participating in and meeting the requirements of the American Industrial Hygiene Association's (AIHA) Proficiency Analytical Testing (PAT) or Laboratory Accreditation program. Results of personnel exposure monitoring shall be used to select the appropriate combination of engineering controls, work practices and personal protective equipment to reduce and maintain employee exposure levels to or below the permissible exposure limits for substances specified in 29 CFR 1910 and to or below published exposure limits for substances not regulated by 29 CFR 1910.

Monitoring of the workers breathing zone must be conducted throughout field operations to verify employee exposures. The following monitoring procedures must be followed as a minimum.

4.10.1.1. **Flame Ionization Detector (FID).** A FID shall be used during all intrusive activities to document employee exposures. The FID shall be operated continuously throughout intrusive activities. A minimum of one documented reading every 30 minutes shall be obtained from within the breathing zone of the worker with the highest potential for exposure. Between documented sampling events, the FID may be placed within the work area for continuous area monitoring.

4.10.1.2. Combustible Gas Indicator (CGI). Area monitoring with a CGI shall be conducted continuously during all intrusive activities.

4.10.1.3. Ammonia Tubes. Monitoring for ammonia concentrations shall be conducted as needed during field activities. Monitoring will be conducted using real time monitoring tubes such as Draeger Ammonia tube 5/a (or the equivalent). Monitoring will be required when ammonia concentrations are high enough to be irritating to any personnel on site. If concentrations which exceed 50% of the PEL are detected, personnel shall examine the air treatment system for possible malfunction. If concentrations cannot be controlled, a review of health and safety procedures and monitoring requirements may be required as high ammonia concentrations may be indicative of exceedances of exposure limits for other organic contaminants.

4.10.1.4. Integrated Sampling. Eight hour time weighted average samples must be collected to verify employee exposures. Personnel samples must be collected during initial intrusive activities on site. If concentrations are detected which exceed 50% of the permissible exposure limit, additional sampling may be required in order to determine appropriate engineering controls or protective equipment. The following methods should be used to document exposures to potential contaminants:

COMPOUND	SAMPLING METHODOLOGY
4-Chlorophenyl methyl sulfoxide	PMRMA CM03
Dimethyldisulfide	OSHA IMISD651
Dimethyl methylphosphonate	PMRMA CM03
Diisopropyl methylphosphonate	PMRMA CM03

In addition, samples may be collected on a 3 stage carbon molecular sieve adsorption tube. Samples shall be analyzed by thermal desorption and mass spectrometer analysis. Some unknown contaminants may be identified by this methodology.

4.10.2. Action Levels Acceptable limits for contaminants on this site are those promulgated in the most recent Permissible Exposure Limits listed in 29 CFR 1910.1000 and/or American Conference of Governmental Industrial Hygienists "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices." Action levels must be set at no more than half of the more restrictive value (PEL or TLV). For compounds with no established PEL or TLV, action levels shall be set at D_T values established by the US Army Medical Bioengineering Research and Development Laboratory. Minimum action levels for changes in PPE levels and for stop work requirements are presented below. These requirements establish only minimum action levels. A competent industrial hygienist must evaluate on site conditions and determine whether revisions to these action levels are necessary.

MONITORING METHOD	COMPOUND	LEVEL B	STOP WORK
OVA	Volatile Organics	> 1 ppm above background - non-ammonia	
CGI	Combustible gases		20% LEL
Ammonia Tubes	Ammonia	35 ppm	
Integrated	Dimethyl disulfide	8 ppb	
Integrated	4-Chlorophenyl methyl sulfoxide	6.2 ppb	
Integrated	Dimethyl methyl phosphonate	31.2 ppb	
Integrated	Diisopropyl methyl phosphonate	75 ppb	

4.11. STANDARD OPERATING PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES. SOPs from the safety and health program required in Section 3 above may be referenced to satisfy the requirements of this section. Any referenced SOPs shall be attached to the site-specific safety and health plan.

4.11.1. Prohibitions during field activities. Specific prohibitions not addressed elsewhere in the site-specific safety and health plan shall be listed here. The following items shall be listed within this Section if they would not otherwise be addressed in the plan.

4.11.1.1. No running or horseplay.

4.11.1.2. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the exclusion zone and the contamination reduction zone. Drinking of water, Gatorade, or equivalent fluids may occur in the contamination reduction zone at the discretion of the site safety and health officer.

4.11.1.3. Smoking, carrying lighters and/or matches is prohibited in the exclusion zone and the contamination reduction zone.

4.11.1.4. No jewelry may be worn by personnel engaged in field work, except for watches, which shall be disposed of if they become contaminated.

4.11.1.5. Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel during operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverages shall not be allowed during breaks.

4.11.1.6. No person shall enter an exclusion zone alone. Use of the buddy system (29 CFR 1910.120 (a)(3)) shall be required.

4.11.1.7. Safety devices on equipment shall be left intact and used as designed.

4.11.2. Materials Handling. Blowdown liquid will be generated by the ammonia scrubber. The liquid will be stored in a tank truck and then transported to the CERCLA Wastewater Treatment Facility for disposal. The insoluble debris (sludge) that remain in the tank after dissolution will be dewatered, drummed, and transported to Building 785 for storage. All liquids generated during decontamination will be pumped to settling tanks, the solids allowed to settle out, and transported by tank truck to the CERCLA Wastewater Treatment Facility. The liners and geonet will be removed, decontaminated, packaged and transported to an offsite RCRA Subtitle C permitted landfill. Personnel exposure to those materials will be limited by handling procedures and by requiring the appropriate PPE.

Personnel must assure that lines are not under pressure and are not filled with contaminated liquids before disconnecting. The contractor shall prepare a standard operating procedure to protect personnel from chemical and physical hazards when connecting and disconnecting lines.

4.11.3. Drum/container handling procedures and protection. The contractor shall develop procedures for movement and disposal of drums which are in compliance with 29 CFR 1910.120(j).

4.11.4. Hot work, sources of ignition. Procedures shall be devised to insure flammable and combustible liquids are stored and handled as specified in EM 385-1-1, Section 12.D. A protocol for obtaining hot work permits shall be established. Portions of EM 385-1-1, Section 13 regarding the use and placement of portable fire extinguishers shall be incorporated.

4.11.5. Electric shock prevention. All work conducted on this site shall be in comply with 29 CFR 1910 Subpart S and 29 CFR 1926 Subpart K. Subjects addressed in EM 385-1-1, Section 15 shall be reviewed and comments regarding each section shall be made. Specific subject titles to be addressed include but are not limited to the following:

- 4.11.5.1. General
- 4.11.5.2. Disconnecting and overcurrent protection
- 4.11.5.3. Grounding
- 4.11.5.4. Temporary wiring
- 4.11.5.5. Operations adjacent to overhead lines
- 4.11.5.6. Battery charging
- 4.11.5.7. Lockout and tagging of circuits
- 4.11.5.8. Hazardous locations
- 4.11.5.9. Power transmission and distribution
- 4.11.5.10. Clearance procedures described in EM 385-1-1,

Section 28.

4.11.6. Excavation Safety. No excavations are currently anticipated for this project. However, if excavations become necessary for project completion, all work will be completed in compliance with OSHA 29 CFR 1926 subpart and section 23 of EM 385-1-1.

4.11.7. Heavy equipment operation.

4.11.7.1. A competent person shall be designated to inspect all equipment and machinery daily to insure it is in safe operating condition. As a minimum, tests shall be made to determine that the brakes and operating systems are in proper working condition. Records of inspections shall be maintained at the site by the contractor and shall become part of the official project file.

4.11.7.2. Procedures shall be established to ensure that machinery found to be defective is removed from service until the unsafe condition has been corrected. The usage of accident prevention signs and tags, as described in 29 CFR 1926.200 shall be incorporated into the procedures to be established.

4.11.7.3. Equipment operators must comply with provisions of EM 385-1-1, Section 05.B

4.11.7.4. All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded which may be contacted by personnel or which may otherwise create a hazard. Guarding shall meet the requirements of ANSI B15.1, Safety Standards for Mechanical Power Transmission Apparatus.

4.11.7.5. All hot surfaces of equipment shall be guarded or insulated to prevent injury or fire.

4.11.7.6. Fuel tanks shall be located in a manner which shall not allow spills or overflows to run onto the engine, exhaust, or electrical lines.

4.11.7.7. Platforms, footwalks, steps, handholds, guardrails, and toeboards shall be provided on machinery to promote safe footing. Accumulations of snow, ice, oils, greases, or any substance likely to increase the likelihood of a slip shall be removed before such surfaces are used.

4.11.8. Fall prevention/protection. Procedures to identify and eliminate or clearly mark tripping hazards and slippery surfaces shall be established. PPE used for this work shall be evaluated for slip, trip and fall hazards prior to selection. If ramps, runways, platforms, scaffolds, or towers are used, the applicable portion(s) of EM 385-1-1, shall be incorporated.

Steps shall be placed into the berm which is built near the tank to allow for safe ingress and egress of the area.

4.11.9. Work during darkness/illumination. Minimum levels of illumination specified in 29 CFR 1910.120(m) and 29 CFR 1926.26 shall be provided at each work site for any field activities conducted after sunset and for all work conducted within the tank.

4.11.10. Sanitation. Provisions shall be included to insure compliance with 29 CFR 1910.120(n). As a minimum, the following subjects shall be addressed.

4.11.10.1. Potable Water

4.11.10.2. Nonpotable water

4.11.10.3. Food handling

4.11.10.4. Toilet facilities

4.11.10.5. Temporary sleeping quarters

4.11.10.6. Washing facilities

4.11.10.7. Showers and change rooms

4.11.11. Visitors. A means shall be devised and implemented to insure all visitors sign-in on a visitors log. A method shall also be devised and implemented to insure visitors to hazardous field activities are medically qualified and have the safety and health training prerequisites required to visit hazardous waste operations.

4.11.12. Contamination prevention. Guidance provided in DHHS (NIOSH) Publication No. 85-115, Section 10, page 10-1, shall be implemented as a minimum.

4.11.13. Heavy Material Handling. Procedures for implementing applicable portions of EM 385-1-1, Section 11 and 29 CFR 1926.250(a) and (b) shall be included. Procedures for periodically briefing proper lifting techniques designed to reduce back injury shall be devised and implemented.

4.11.14. Hazardous Noise. Procedures to protect employees from the effects of noise exposure shall be devised. Minimum standards for controlling noise exposures are specified by 29 CFR 1926.52. Those minimum standards shall be incorporated into the procedures.

4.12. SITE CONTROL MEASURES. Site control procedures shall be described. These shall include a site map with work zones and access points delineated. Site security (physical and procedural) shall also be described.

A minimum of three work zones shall routinely be used to reduce the accidental spread of hazardous substances from contaminated areas. Criteria for the establishment of an exclusion zone, a contamination reduction zone and a support zone shall be established. Guidance presented in DHHS (NIOSH) publication No. 85-115, Section 9 shall be used.

Specific details regarding the location of the command center, support zone, contamination reduction zone and exclusion zone will be identified in the 90% submittal. In addition, a site map with work zones and access points is included in Figure G-7.

The guidance provided in DHHS (NIOSH) Publication 85-115 shall be used as the basis for devising a communications system that includes a method of internal communications between field teams and the base of field operations and that includes external communications between on site personnel and off-site personnel.

4.13. PERSONAL HYGIENE AND DECONTAMINATION. Decontamination procedures in the form of SOPs shall be developed, communicated to employees, and the decontamination station completely set up before any employees or equipment may enter areas where a potential for exposure to hazardous substances exists. Personnel must practice emergency evacuations and emergency decontamination procedures before site work begins. Decontamination procedures shall comply with requirements established by 29 CFR 1910.120.

All employees leaving a contaminated area must 1) process through the decontamination station and wash, rinse and remove contaminated PPE before entering the support zone, and 2) shower before leaving the site. At a minimum, a decontamination solution of Alconox and water shall be used at a decontamination station. Showers and change rooms shall meet the requirements of 29 CFR 1910.141. Standard operating procedures for personnel decontamination shall be developed which detail frequency, locations, and supplies required to accomplish decontamination.

4.14. EQUIPMENT DECONTAMINATION. Standard operating procedures for equipment decontamination shall be developed which detail facilities, location, frequency, and supplies required and methods to determine adequacy. Contaminated equipment and clothing shall be disposed of or decontaminated. Gross decontamination of equipment will be conducted within the tank. All removable plates and covers will be removed to allow any contamination to be cleaned. The equipment will then be transported to the decontamination bay using flatbed trailers that have plastic lined beds. Final decontamination will be conducted in the bay which is located at the CERCLA Wastewater Treatment Facility on the northwest corner of 7th Avenue and "C" Street.

PPE shall be decontaminated to the extent possible and placed in drums at the decontamination station. The procedures specified in Section 4.11.12 above shall be implemented whenever feasible in order to reduce the volume of contaminated waste generated whenever possible.

4.15. EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS. At a minimum, the following emergency equipment shall be immediately available on site:

4.15.1. First Aid Kit. Provisions for implementing the requirements contained in EM 385-1-1, Section 4B shall be included. Each field team shall carry a first aid kit.

4.15.2. Emergency Eyewashes/Showers. Emergency eye washes/showers shall be available on site and shall be in compliance with ANSI Z358.1

4.15.3. Emergency Use Respirators.

4.15.4. Spill Control Materials and Equipment.

4.15.5. Fire Extinguishers. The type of extinguishers required, as well as the size and the location on site must be specified.

4.16. EMERGENCY RESPONSE PLAN AND CONTINGENCY PROCEDURES. Procedures that incorporate the requirements established in 29 CFR 1910.120(1) shall be implemented. As a minimum, the following subjects shall be addressed:

4.16.1. Pre-emergency planning

4.16.2. Incident reporting procedures

4.16.3. Personnel roles/lines of authority

4.16.4. Posted instructions/list of emergency contacts

4.16.5. Emergency recognition and prevention

4.16.6. Site topography/layout/prevailing winds

4.16.7. Site evacuation procedures

4.16.8. Emergency decontamination and medical treatment

4.16.9. Medical facility route map

4.16.10. Critique and follow-up of emergency responses

In case of a physical or chemical injury, the RMA Fire Department shall be contacted for emergency medical treatment and ambulance service. The emergency medical facilities used for this work are:

AMI Presbyterian Aurora Hospital
700 Potomac (I-225 at 6th Avenue exit)
Aurora, Colorado

For Chemical Agent Injuries (not anticipated)

Fitzsimmons Army Hospital
Building 500
West Gate
Peoria and Montview
Aurora, Colorado

4.17. HEAT/COLD STRESS MONITORING. Methods for limiting heat and cold stress shall be devised and implemented. Guidance provided in DHHS (NIOSH) Publication No. 85-115, Section 8 shall serve as the basis for procedures developed to limit heat stress. The guidance provided in the most recent edition of the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices, American Conference of Governmental Industrial Hygienists shall serve as the basis for procedures to limit employees exposure to cold stress.

Depending on site conditions either a work rest regime or use of appropriate personal cooling devices (section 4.8.1.3.10) shall be employed to prevent heat stress during intrusive activities. In addition, adequate precautions shall be made to prevent heat stress in workers who have not been acclimatized.

Personal heat stress monitors will be worn by workers performing high pressure washing in the tank as well as other high heat stress tasks identified by the SSO in order to detect and prevent heat stress illness/injury.

4.18. LOGS, REPORTS, AND RECORD KEEPING

4.18.1. Logs. The site safety and health officer shall maintain a chronological log of daily activities. Required entries include field team(s) work sites, names of all field team members, the level of PPE utilized, justification for all PPE level upgrades and downgrades, results of air monitoring, and inspections of facilities and equipment, and the details of any accidents.

4.18.2. Reports. Procedures shall be devised that incorporate the requirements established in EM 385-1-1, Section 2.

4.18.3. Recordkeeping. Recordkeeping procedures for this site shall comply with all OSHA regulations, including 29 CFR 1904 and 1910.20 (d). A daily record of first aid treatments not otherwise reportable shall be maintained as specified in EM 385-1-1, Section 02.A.05. And a visitors sign-in record shall be established and maintained.

Regularly scheduled supervisor safety meetings and field worker safety meetings shall be held and records maintained of the meetings as described in EM 385-1-1, Section 01.C.

ATTACHMENT A
Site Description and Contamination Characterization

In 1956, Basin F was constructed in the northern part of RMA in Section 26. Basin F had a surface area of 92.7 acres and a capacity of approximately 243 million gallons. The basin was created by construction of a dike around a natural depression and was lined with a 3/8-inch catalytically blown asphalt membrane. An earthen blanket approximately 1 foot thick was placed on top of the membrane to protect it. A vitrified clay pipe with chemically resistant sealed joints was installed between Basin F and the facilities where the wastes were generated. In 1962, a low dike was placed across the southeast corner of the basin to separate an area of approximately 8 acres. From August 1957 until its use was discontinued in December 1981, Basin F was the only evaporative disposal facility in service at RMA.

In 1986, the Department of the Army, Shell Oil Company, and the EPA Region VIII agreed that an accelerated remediation be conducted to contain the liquid and contaminated soils in and under Basin F. This remediation was undertaken pursuant to CERCLA.

The first Interim Response Action (IRA-1) for Basin F liquid, sludges, and soils remediation included the following activities: Basin F liquid was transferred to three lined storage tanks and to one pond of a surface impoundment facility (the north surface ponds). The north surface ponds consist of two double-lined impoundments which are referred to as Pond A and Pond B. A double-lined temporary waste storage pile has been constructed within the former Basin F area. Basin F solids were aerated to dry them prior to placement in the waste pile and final grading and capping of the excavated area. Solids remediation was initiated and performed by Ebasco Constructors, Inc., during 1988 and early 1989.

Transfer of Basin F liquid to tanks for interim storage was initiated in May 1988. Prior to this time, additional liquid retention capacity in the form of the lined north surface ponds had been planned, since seasonal precipitation had increased the volume of the liquid beyond the initial estimate. Approximately 3 million gallons of liquid was pumped from Basin F to the tanks from May 1988 through August 1988.

Transfer of liquid to the tanks commenced while construction of Pond B was completed. Six-thousand-gallon vacuum trucks pumped liquid out of Basin F, transported it to the tank farm and gravity-drained the liquid to a small transfer basin. The liquid was pumped from the transfer basin into the tanks. After completion of Pond B, Basin F liquid was also pumped directly to Pond B during July and August 1988.

During transfer of liquid to Pond B, a solidified stratum of hardened material was uncovered in the basin. An additional 3 million gallons of liquid was entrained within and below this layer. The total capacity of the tank farm and Pond B was insufficient to contain all the Basin F liquid. Remaining Basin F liquid was pumped to Pond A. During August and September 1988, liquid from Pond B was also transferred to Pond A, to allow Pond B to be used for surface runoff and decontamination water. Pond B presently contains no Basin F liquid.

Transfer of an additional 1 million gallons from Pond A to the tanks occurred in December 1988. Approximately 4 million gallons of liquid is presently stored in the tank farm, and approximately 7 million gallons in the north surface facility, Pond A.

The second Interim Response Action for Basin F liquid (IRA-2) addresses treatment and disposal of the contents of the storage tanks and Pond A. This IRA was initiated in September 1988 and is in progress. Further characterization of the stored liquid, selection of a treatment alternative for the liquid, pilot scale

demonstration of the selected treatment technology, and detailed engineering design of the remedial treatment process have been performed. Implementation of the thermal treatment selected has begun and disposal/treatment of Basin F liquid will begin in 1993.

The tank farm lies east of Pond B on 9th Street. The tank farm is comprised of three tanks numbered 101, 102, and 103, and was initially designed to hold all of the Basin F liquid. The three tanks are similar in size and design, and were built in 1987. They contain a total volume of about 4,000,000 gallons of Basin F liquid, each tank containing about 1,330,000 gallons. Each tank is 78.5 feet in diameter and about 40 feet in height. The tanks are lined with a 100-mil HDPE liner with a 200-mil synthetic drainage net leak detection system between the liner and the steel walls. Each tank is covered with an Alumadome roof. The cover of each tank is equipped with one 10-inch diameter vent, one 8-inch diameter gage port, and one hatch 24 inches by 24 inches. Stairs welded to the walls of the tanks provide access to a deck at the top of the steel walls of the tanks. The hatch in each tank roof is located approximately 4 feet from the deck.

The synthetic liners in Tanks 101 and 103 are assumed to be intact, since no leakage has been detected in the leak detection system. The liner in Tank 102 appears to have been damaged, due to the presence of Basin F liquid in the leak detection system. Non-destructive T-scan tests have been run on all three tanks every six months and additional testing has been run on Tank 102. The results of these tests, available from PMRMA, indicate that the three tanks are currently structurally sound. The tank roof is made of aluminum sheets. The strength of the roof may have been affected by contact with the corrosive vapors from the liquid in the tanks.

Basin F liquid is an aqueous liquid containing a complicated mixture of hydrocarbons, chlorinated hydrocarbons, salts, metals, and other process intermediates, by-products, and wastes. It is known that quantities of ammonium phosphate, and later copper sulfate, were added to Basin F at different times. The total organic carbon content (as C) reported for Basin F liquid ranges from 18,000 mg/l to 23,000 mg/l. This indicates that Basin F liquid is approximately 2 percent organic carbon. The major organic species, identified in samples of Basin F liquid in 1988, was 4-nitrophenol. Historical analytical data indicate that a number of pesticides are also present in Basin F liquid, but these levels are relatively low when compared to the overall total organic content (TOC).

Basin F liquid is remarkable in the wide variety of inorganic and organic compounds contained in the liquid. Although the major metallic inorganic species are sodium and potassium, significant amounts of heavy metals, particularly copper, are also present. Analyses conducted to date do not distinguish between metals present as ionic species, metals present as amine complexes, and metals potentially present in more exotic organometallic forms.

Although a significant number of organic chemical species have been identified, many of the organic compounds present in Basin F liquid are unidentified despite the fact that the samples were analyzed for an extensive range of hazardous species including compounds referenced in U.S. Environmental Protection Agency SW-846, Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, 1988. In part, this lack of identification of Basin F liquid organic species is caused by the difficulty of analyzing individual species in the complex matrix. The highly concentrated matrix has resulted in an unavoidable increase in baseline interference and higher detection limits. In addition, based on Shell's experience, many organics may be difficult to extract using standard extraction methods, due to the formation of emulsions.

Numerous studies conducted to characterize Basin F liquid indicate that its contaminants include: alcohols, fluoride, chloride, insecticides, chlorinated organics, chlorophenylmethyl sulfone, pesticides, chlorophenylmethyl sulfoxide,

phenols, dicyclopentadiene, phosphorous, p,p-DDE, p,p-DDT, sulfate, acetophenone, aldrin, isodrin, arsenic, mercury, metals, pentachloroethane, dibromochloropropane, tetrachloroethylene, dithiane, toluene, dieldrin, trichloroethane, xylene, dimethylmethyl phosphonate (DMMP), endrin, and diisopropylmethyl phosphonate (DIMP). Table A-1 list results of several past and current analyses of Basin F liquid.

Basin F liquid is also remarkably high in urea according to historical results (Table A-1). In general, the presence of urea would be indicative of a reducing chemical matrix. The extremely high chemical oxidation demand (COD) results suggest that Basin F liquid is a reducing matrix.

During the first Basin F IRA it was found that Basin F liquid, while still in the basin, tended to stratify. The stratification consisted of an aqueous layer on top, then a layer of crystallized material, beneath which was a layer of slushy and highly volatile organic fluids and sludges. This distinct stratification has not been observed in the tanks or Pond A, although a crystal layer has been observed on the bottom of Pond A and the tanks.

Basin F liquid was found to contain extremely high levels of total Kjeldahl nitrogen, expressed as N, in the range of 101 to 104 grams per liter (g/l). Approximately 50 percent of this amount is attributed to ammonia or ammonium ion, while the remainder of the reported nitrogen (as N) is present as urea (Shell 1986), although traces of nitrogen in other forms, such as nitrate, are undoubtedly present. Effervescence, noticed during sampling and filtering, is likely attributable to off-gassing of saturated or loosely complexed ammonia. The high ammonia content of Basin F liquid presents numerous problems in handling, transfer, and treatment.

Basin F liquid is of neutral Ph but is electrolytically corrosive. Although the ionic strength of Basin F liquid was not determined, Basin F liquid has an ionic strength (salt content) approximately ten times that of seawater. Basin F liquid was also found to contain near-saturated levels of ionic inorganic species. It is assumed from the history of liquid disposal in the basin and other information that the primary cationic species are Na^+ , K^+ , Cu^{+2} , Mg^{2+} , and NH_4^+ , and that the anionic species are Cl^- , F^- , SO_4^{2-} and NO_3^- .

The high ionic strength has two major impacts on implementation of the treatment alternative. First, any further concentration of the liquid (liquid removal) will increase salting-out of major species. Second, Basin F liquid is likely to be very corrosive because of the high salt content and the metal complexing capability of ammonia.

Personal air sampling including WPA Method T01/02/03 using Carbotrap 300 adsorbent, thermal desorption and GC/MS analysis was performed during the Basin F sampling activities in September/October 1991. Basin F liquids remained at ambient temperatures throughout the sampling activities.

The following contaminants were detected in the sample: acetone, acetonitrile, 2-butanone, trichloroethane, trichloroethene, benzene, tetrachloroethene, toluene, ethylbenzene, xylene, acetic acid. Contaminants were all detected at below ppm levels, and all were orders of magnitude lower than applicable Permissible Exposure Limits.

Freons, pentane, cyclopentane, styrene, and 2-methyl butanone were also detected during sampling. These compounds are all related to blowing styrenes. Since there is no historical evidence of these compounds in Basin F, they are presumed to be from the large pieces of styrofoam that were used for a floating bridge during field activities.

Basin F liquids were tested for volatile components in June of 1992. Samples of volatiles emitted when Basin F fluids were heated to 60° C were collected at Waterways Experiment Station. Below ppm concentrations of acetonitrile, and acetone were detected during sample analysis. Ammonia was detected at concentrations of 10 - 75 ppm.

ATTACHMENT B

Hazard Assessment and Risk Analysis

Exposure limits and properties of the contaminants identified in the Basin F liquids were reviewed and are included in Table B-1. Permissible Exposure Limits promulgated by the Occupational Safety and Health Administration are listed for all compounds for which such limits have been identified. Similarly, Threshold Limit Values issued by the American Conference of Governmental Industrial Hygienists are also listed. For compounds with no identified exposure limits, D_r values were listed if available. Developed by the US Army Medical Bioengineering Research and Development Laboratory, D_r values are conservative estimates of toxicity and may be based on very limited data.

Raoult's Law was used to preliminarily identify volatile contaminants of concern from this list of known contaminants. Based on these calculations, the following compounds were identified as a potential concern for inhalation exposure during field activities: 4-chlorophenyl methyl sulfoxide, ammonia, dimethyl methyl phosphonate, diisopropyl methyl phosphonate, dimethyl disulfide.

The above assessment is considered a conservative as the results of the previous air sampling (Section 3.6.2), showed no significant volatile organic vapor hazard.

Ammonia and dimethyl disulfide are significant odor emitting compounds. Ammonia has been detected higher concentrations than any other contaminant during recent sampling events. As noted in Table B-1, ammonia has an odor threshold of 0.3 - 40 mg/m³, and dimethyl disulfide has an odor threshold of 0.003 - 0.029 mg/m³. The health effects of ammonia are mainly irritation of the respiratory tract and mucous membranes. It is expected that ammonia will be irritating to workers at concentrations well below their acute toxicity level. Dimethyl disulfide emitted significant odors during previous field activities involving Basin F liquids, however, no concentrations of dimethyl disulfide were detected during the most recent sampling events. Therefore, it is unknown whether this compound will be detected during this project. Due to the ability to detect ammonia and dimethyl disulfide at low concentrations, these compounds can be considered indicative of total organic vapor concentrations.

The greatest human health hazard during this project is expected to result from direct contact with Basin F liquids (i.e. skin contact or inhalation of aerosolized liquids). Not only are Basin F liquids known to be corrosive, but contaminants may be absorbed through the skin during contact.

The field activities for this project are outlined in appropriate specifications. A summary of the tasks is given below.

Site Preparation and Demobilization

- Set up exclusion zones, decontamination trailer
- Collection of grab samples of the dissolution product
- Set up the propane tank
- Site grading
- Placing a 100 mil HDPE liner,
- Build a ramp to the bottom of the tank access opening
- Install a wastewater removal system
- Installation of the air treatment system - nonintrusive activities
- Installation of the heating and recirculation system - nonintrusive activities
- Install tank decontamination hot water supply
- Cut a hole in the tank

Intrusive Site Preparation

- Installation of the air treatment system - cut the hole for installing the air duct
- Installation of the heating and recirculation system - open the hatch for installing piping
- Install lighting system
- Install sludge handling system
- Install automatic tank washer

Tank Decontamination:

- Dewater sludge
- Remove sludge with skid steer loaders
- Primary decontamination of tank liner and alumadome roof
- Removal and final decontamination of the liner
- Removal and final decontamination of the geonet
- Decontaminate tank wall and bottom

Equipment Decontamination:

- Decontaminate skid steers
- Decontaminate equipment

During field activities, physical hazards will include standard construction hazards. These will include but are not limited to confined space entry; uneven ground; slip, trips, and falls; sensory and dexterity hazards from wearing personal protective equipment (PPE); electrical hazards; cutting and welding hazards; heat and cold stress; noise; and physical and overhead hazards involved with the use of heavy equipment, personnel hoists, and cranes, ingress and egress into bermed area near the tank.

Chemical hazards during site preparation and demobilization are expected to be limited. Exposures to Basin F liquids are not anticipated. Personnel shall wear protective equipment during these activities which will protect them from physical construction hazards.

By the time the opening in the tank is made, the air handling system will be in place. This system is designed to pull 4 air exchanges per hour. The tank will be under negative pressure. It is anticipated that all contaminated materials will be pulled into the tank away from the breathing zone of the workers. When making the cut in the tank, it is critical that water is sprayed into the cut behind the cutting torch to keep the HDPE liner and the geonet from igniting.

To connect the hot water supply system, valves on ST101, P101, and HE101 must be opened. The potential exists for very small amounts of dilute Basin F liquids to be in the piping. Personnel must don splash protection to prevent exposure during this operation.

All intrusive site preparation activities, tank decontamination and equipment decontamination activities will require potential exposure to either high concentrations of Basin F liquids or aerosolized Basin F liquids. These activities must be conducted in self contained breathing apparatus or airlines, and skin protection.

Intrusive site preparations and tank decontamination will require personnel to enter the tank through either the side opening or through the roof hatch. Due to the potential chemical exposure hazards and the physical hazards caused by the use of mechanical equipment within the tank, entry into the tank must be treated as a confined space entry. Confined space permits must be prepared prior to entry for each work shift which will identify required safety equipment and procedures. Pre-entry air monitoring must be conducted.

Heat stress will be a significant hazard during intrusive site preparations and tank decontamination. Methods for limiting heat and cold stress shall be devised and implemented. Depending on site conditions either a work rest regime or use of appropriate personal cooling devices (section 4.8.1.3.10) shall be employed to prevent heat stress during intrusive activities. In addition, adequate precautions shall be made to prevent heat stress in workers who have not been acclimatized.

During site preparation the heating and recirculation system will be installed on site. These will include a 6,000 gallon propane tank and piping which will contain oil which will be heated to 600° F. Sources of ignition must be kept away from the propane tank, and personnel must be notified of the hazards associated with accidental breakage of the heated oil line.

The air treatment system will include a wet scrubber which will remove ammonia from the air by precipitating it out in solution. The result will be blowdown water which will contain ammonia and some volatile organics. Personnel will be required to connect and disconnect hoses when the blowdown water is pumped from the air treatment system to tank trucks on site. No significant inhalation exposure is anticipated for this activity. Personnel will be required to don protective equipment to prevent direct skin contact with blowdown water.

Similarly, liquids from the settling tanks will be pumped from the tanks to nearby tanker trucks. Personnel must don splash protection to prevent direct skin contact while connecting and disconnecting lines.

Disconnecting lines will be a potential physical and chemical exposure hazard during this work. Personnel must assure that lines are not under pressure and are not filled with contaminated liquids before breaking lines.

Additional hazards may be encountered during this work depending on site conditions. Potential hazards must be analyzed on a task-specific basis by a competent safety and health professional.

TABLE A-1

CHEMICAL CHARACTERIZATION OF BASIN F LIQUID

Compound/ Parameter	Unit	Historical (1978)	RMA (1980)	EBASCO (1986)	Shell (1986)	WES (1986)	Concentration/Range		WCC (1988)
							(Unfilt.)	(Filt.)	
pH	---	6.9-7.2	*	6.02	6.0	5.7	6.1-6.3**	5.8**	
Aldrin	ppb	50.0-400	23.8	2,300	420	na	2,500-2,900	1,100	
Isodrin	ppb	2.0-15	7.57	1,980	90	na	nd	nd	
Dieldrin	ppb	5.0-110	7.15	459	300	na	nd	nd	
Endrin	ppb	5.0-40	1.98	596	180	na	nd	nd	
Dithiane	ppb	30.0-100	5.0	---	*	na	+	+	
ppDDE	ppb	*	*	109	*	na	nd	nd	
ppDDT	ppb	*	*	340	*	na	nd	nd	
CPMSO	ppb	4,000-10,000	25,800	1,000	20,000	na	+	+	
CPMSO ₂	ppb	25,000-60,000	80,800	1,000	200,000	na	+	+	
Hexachlorocyclo- pentadiene	ppb	*	*	1,850	*	na	nd	nd	
Atrazine	ppb	*	*	220*	*	na	nd	nd	
Malathion	ppb	*	*	*810	*	na	nd	nd	
Parathion	ppb	*	*	*110	*	na	nd	nd	
Supona	ppb	*	*	*340	*	na	nd	nd	
Vapona	ppb	*	*	*890	*	na	nd	nd	
Benzene	ppb	*	*	*7.7	*	na	nd	nd	
Bromomethane	ppb	*	*	*	*	*	nd-18	na	

TABLE A-1
(Continued)

Concentration/Range								
Compound/ Parameter	Unit	Historical (1978)	RMA (1980)	EBASCO (1986)	Shell (1986)	WES (1986)	WCC (1988)	
							(Unfilt.)	(Filt.)
Chloroform	ppb	*	*	*	*	*	1.9-3.1	na
Toluene	ppb	*	*	*	*	*	8.3-9.8	na
4-Nitrophenol	ppb	*	*	*	*	*	8,600-18,000	7,400
DIMP	ppm	10.0-20	*123	0.4	<0.1	na	nd	nd
DMMP	ppm	50-2,000	556	na	760	na	nd	+
Ammonia	ppm	*	*	na	57,800	40,700	48,900-60,900	53,000
Urea	ppm	*	*	na	143,000	na	na	na
Dimethyldisulfide	ppm	*	*	na	80-120	na	+	md
Calcium	ppm	*	*	6.8	270	na	170-190	180
Potassium	ppm	*	*	30	1,100	na	1,000-2,900	1,000-2,700
Sodium	ppm	*	65,000	2,300	49,000-61,000	na	60,000	54,000
Chloride	ppm	48,000-56,000	110,000	120,000	159,000	na	120,000-130,000	130,000
Fluoride	ppm	110-117	170	21	55	na	***	***
Sulfate	ppm	21,000-25,000	*	na	47,000	na	25,000-27,000	27,000
Nitrate	ppm	*	*	*	*	*	1,300	1,300
Nitrogen	ppm	120-145	*	na	*	na	103,700-104,400	101,300
Phosphorus (total)	ppm	2,050-2,150	*	na	16,200	na	8,600-9,140	8,400
Hardness	ppm	2,100-2,800	*	na	*	na	na	na

TABLE A-1
(Continued)

Concentration/Range								
Compound/ Parameter	Unit	Historical (1978)	RMA (1980)	EBASCO (1986)	Shell (1986)	WES (1986)	WCC (1988)	
							(Unfilt.)	(Filt.)
Alkalinity	ppm	*	*	*	*	*	1,500-1,600	2,000
Aluminum	ppm	*	*	*	*	*	5.0-5.5	3.1
Antimony	ppm	*	*	*	*	*	.6-1.1	0.6
Arsenic	ppm	1.0-1.3	2.1	3.0	8	3.1	3.0-3.9	3.8
Barium	ppm	*	*	*	*	*	0.4	0.4
Boron	ppm	*	*	*	*	*	19	21
Cadmium	ppb	*	*	8.4	<2,000	na	30-50	40
Chromium	ppb	*	*	85	1,000	na	1,500-1,800	1,900
Cobalt	ppm	*	*	*	*	*	.82-.93	.93
Copper	ppm	700-750	*	210	5,200	5,860	3,900-4,000	4,200
Iron	ppm	5.0-6.0	*	na	75	na	59-62	58
Lead	ppb	*	*	74	<2,000	na	nd	nd
Magnesium	ppm	35-40	*	5.6	220	na	230-250	250
Manganese	ppm	*	*	*	*	*	6.8-7.2	7.1
Nercury	ppb	26-29	*	140	200	na	340	340
Molybdenum	ppm	*	*	*	*	*	2.4-2.5	2.6
Nickel	ppm	*	*	*	*	*	31-34	33
Vanadium	ppm	*	*	*	*	*	2.5-3.0	2.6
Zinc	ppm	*	*	.95	22	na	23	23
Cyanide	ppm	1.45-1.55	*	na	*	na	.68-1.2	.68

TABLE A-1
(Continued)

Compound/ Parameter	Unit	Historical (1978)	RMA (1980)	EBASCO (1986)	Shell (1986)	WES (1986)	WCC (1988)	
							(Unfilt.)	(Filt.)
COD	ppm	24,500-26,000	*	na	158,000	na	220,000-230,000	210,000
TOC	ppm	20,500-22,500	29,600	na	72,000	97,000	18,000-23,000(S)	22,000(S)
Total Organic Halide (TOX)	ppb	*	*	*	*	*	380,000-570,000	340,000
TSS	ppm	*	*	*	*	*	1,500-1,600++	1,100++
Specific Gravity	---	*	*	*	*	*	1.24	1.24
Conductivity	μmhos/c m	*	*	*	*	*	110,000	110,000
Viscosity 2°C		*	*	*	*	*	4.6-4.7	5.0
Viscosity 10°C							3.4	2.8
Viscosity 15°C							2.9	3.1
Viscosity 20°C							2.5	2.6
Viscosity 25°C							2.1	2.3

* Exact analytical procedures unclear, assumed to be "not analyzed for"
 ** pH for this type of solution must be interpreted with care. Measured 36 days after sample collection
 *** not quantifiable due to matrix interference
 + tentatively identified compound, see chemical analysis tables
 ++ TSS measured 8 days after sample collection
 na not analyzed for
 nd not detected
 S Suspect due to COD:TOC ratio and past results

EXPOSURE LIMITS AND PROPERTIES OF COMPOUNDS DETECTED IN BASIN F LIQUIDS

COMPOUND	CAS #	OSHA PEL	ACGIH TLV/ D, VALUES	IDLH	VAPOR PRESS. in mm @ 68 F	SPEC. GRAVITY @ 68 F	SKIN HAZARD	ODOR THRESHOLD (PPM)	CARC CAT.	HNU % RESPONSE (BENZENE)		OVA % (METHANE) RESPONSE	IP (eV)
										10.2 eV	11.7eV		
Acetone	67641	750 ppm 1000 ppm S	750 ppm 1000 ppm S	2000 ppm	180	0.79	NO	mint like 47.5 - 1813.8 mg/m ³	IRIS D	6.3	6.7	60	9.88
Aldrin	308002	0.25 mg/m ³	0.25 mg/m ³	100 mg/m ³	0.00008	1.60	YES	odorless	IRIS B2	NA	NA	NA	
Aluminum (metal dust)	7429805	10 mg/m ³	10 mg/m ³ (T) 5 mg/m ³ (R)	NE	1 mm @ 1284°C	2.7	NO		NE	NA	NA	NA	
Ammonia	7664417	35 ppm S	25 ppm 35 ppm S	500 ppm	> 1 atm	0.7710 G/L @ 760 MM HG	NO	sharp, cloying repellent 0.266 - 39.6 mg/m ³	NE	0.3		NA	10.18
Antimony	7440360	0.5 mg/m ³	0.5 mg/m ³	80 mg/m ³	~0	6.68	NO		NE	NA	NA	NA	
Arsenic (Organic)	7440382	0.5 mg/m ³	0.2 mg/m ³	Varies	Varies	Varies		Varies					
Arsenic (Inorganic)(Metal)	7440382	0.01 mg/m ³	0.2 mg/m ³	100 mg/m ³	~0	5.73	NO	~odorless	IRIS A	NA	NA	NA	
Atrazine	1812-24-9	5 mg/m ³	5 mg/m ³	~0	~0	1.187 g/cm ³	NO	~odorless	NE	NA	NA	NA	
Barium (soluble)	Barium Nitrate	0.5 mg/m ³	0.5 mg/m ³	1100 mg/m ³	10 @ 1049C	3.24	NO		NE	NA	NA	NA	
	Barium Chloride					3.86							
Benzene	71432	1 ppm 5ppm S	0.1 ppm (a) 10 ppm	3000 ppm	75	0.88	YES	aromatic 6 - 119 ppm	IRIS A	10	12.2	150	8.24
Boron	7440-42-8	NE	NE	~0	2.3	Varies	YES		NE	NA	NA	NA	
Boron Oxide	1303-86-2	5 mg/m ³ R 10 mg/m ³ T	10 mg/m ³	NE	~0	2.46	NO		NE	NA	NA	NA	
Bromomethane (Methyl Bromide)	74-83-9	5 ppm	5 ppm	2000 ppm	> 1 atm	1.73	YES	~odorless	IRIS D			76	10.54
Cadmium (dust)	7440439	0.2 mg/m ³ 0.6 mg/m ³ C	0.01 mg/m ³ T (a) 0.002 mg/m ³ R (a) 0.05 MG/M ³	50 mg/m ³	~0	8.65 @ 77°F	NO	~odorless	IRIS B1	NA	NA	NA	
Carbon Disulfide	75150	4 ppm 12 ppm S	10 ppm	500 ppm	297	1.26	YES	ether-like odor	NE	7.1	33.8	NA	10.08

Carcinogenic Category

mg/m³ = milligrams of contaminant per cubic meter of air
ppm = parts of contaminant per million parts of air
NE = Not Established

- OSHA = Occupational Safety and Health Administration
ACGIH = American Conference of Governmental Industrial Hygienists
IRIS = Integrated Risk Information System
IRAC = International Agency For Research on Cancer
PEL = Permissible Exposure Limit, unless noted is the TWA, Time Weighted Average (usually for 8 hours a day, 5 days a week), mandated by law
TLV = Threshold Limit Value, unless noted is the TWA, Time Weighted Average (usually for 8 hours a day, 5 days a week), recommended by ACGIH
IDLH = Immediately Dangerous to Life or Health
Skin Hazard = Contaminant can be absorbed through intact skin.
D₁ Value = Contaminant intake that should not induce adverse effects to human health or should not pose a risk of cancer occurrence greater than a predetermined risk level. Developed by US Army Medical Bioengineering Research and Development Laboratory

mg/m³ = milligrams of contaminant per cubic meter of air
ppm = parts of contaminant per million parts of air
NE = Not Established
NA = Not Applicable
T = Total Dust
R = Respirable Dust
C = Ceiling Limit, shall not be exceeded at any time during the work day
S = Short Term Exposure Limit (STEL) usually 15 minutes, four times in one day
D = D₁ Value in mg/kg/day
S/5/2 = STEL for 5 minutes, twice in one day
a = These TLVs have not yet been adopted. ACGIH has placed them under notice of intended changes.
b = This PEL/TLV is for all Coal Tar Pitch Volatiles combined. Separate PEL/TLVs have not been established to date

IRIS IARC
A 1 Human Carcinogen
B1 2A Probable Human Carcinogen (limited human data)
B2 2B Probable Human Carcinogen (sufficient in animals, inadequate evidence in humans)
C 3 Possible Human Carcinogen
D 4 Not Classifiable
E Evidence of Non-Carcinogen

EXPOSURE LIMITS AND PROPERTIES OF COMPOUNDS DETECTED IN BASIN F LIQUIDS

COMPOUND	CAS #	OSHA PEL	ACGIH TLV/ D, VALUES	IDLH	VAPOR PRESS. in mm @ 68 F	SPEC. GRAVITY @ 68 F	SKIN HAZARD	ODOR THRESHOLD (PPM)	CARC CAT.	HNU % RESPONSE (BENZENE)		OVA % (METHANE) RESPONSE	IP (eV)
										10.2 eV	11.7eV		
Chloroform	67663	2 ppm	10 ppm	1000 ppm	180	1.48	NO	pleasant 130 - 1000 ppm	IRIS B2	NE	6	65	11.42
4-Chlorophenyl methyl sulfone (CMPSO)	98-57-7	NE	0.067 (D)	NE	0.0005 @ 25°C		Possibly		NE	NA	NA	NA	
4-Chlorophenyl methyl sulfoxide (CMPSO)	934-73-6	NE	0.0082 (D)	NE	0.0008 @ 25°C		Possibly		NE	NA	NA	NA	
Chromium (metal)	7440473	1 mg/m ³	0.5 mg/m ³	NE	-0	7.14	NO		NE	NA	NA	NA	
Chromium III	18068831	0.5 mg/m ³	0.5 mg/m ³	NE	varies	varies	YES		NE	NA	NA	NA	
Chromium VI	7440-47-3	NE	0.05 mg/m ³	NE	-0		NO		IRIS A	NA	NA	NA	
Cobalt	744484	0.05 mg/m ³	0.05 mg/m ³	20 mg/m ³	-0	8.92	NO		NE	NA	NA	NA	
Copper (dust)	7440508	1 mg/m ³	1 mg/m ³	NE	-0	8.94	NO		IRIS D	NA	NA	NA	
Cyanide	KCN	5 mg/m ³	5 mg/m ³	50 mg/m ³	-0	1.65	NO	faint, bitter, almond	NE	NA	NA	NA	NA
	NaCN					1.80				NA	NA	NA	
ppPDE (p,p' Dichlorophenyl di chloroethylene)	72-55-9	NE	0.00028 (D)	NE	-0				IRIS B2	NA	NA	NA	
ppDDT (p,p' Dichlorobenzene)	50-29-3	1 mg/m ³	1 mg/m ³	NE	-0	0.99	YES	fruit-like, aromatic 0.35 ppm in water	IRIS B2	NA	NA	NA	
Dieldrin	60571	0.25 mg/m ³	0.25 mg/m ³	450 mg/m ³	-0	1.75	YES	odorless to mild, chemical 0.041 ppm	IRIS B2	NA	NA	NA	
Dimethyldiaulfide	624-82-0	NE	0.00813	NE	21	1.06		0.003-0.029 mg/m ³		NE	NE	20	8.45
Dimethyl methylphosphonate (DMMP)	766-79-6	NE	0.0312 (D)	NE	0.61 @ 25°C	1.150			NE	NE	NE	NE	

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										10.2 eV	11.7eV		
Diisopropyl methylphosphonate (DIMP)	1445-75-6	NE	0.075 (D)	NE	0.28 @ 25°C				IRIS D	NE	NE	NE	
Dithiane	505-23-7	NE	0.02 (D)	NE	0.8 @ 25°C		NE			NE	NE	NE	
Endrin	72208	0.1 mg/m ³	0.1 mg/m ³	2000 mg/m ³	~0	1.70	YES	odorless to faint chemical 0.018 ppm	IRIS D	NA	NA	NA	
Ethyl Benzene	100414	100 ppm 125 ppm S	100 ppm 125 ppm S	2000 ppm	10 @ 78F	0.87	NO	aromatic	IRIS D	NE	NE	100	8.78
Fluoride	Sodium Fluoride 7681-49-4					2.78							
	Sodium Aluminum Fluoride 15096-62-3	2.5 mg/m ³	2.5 mg/m ³	500 mg/m ³	~0	2.90	NO			NA	NA	NA	
Hexachlorocyclopentadiene	77-47-4	0.01 ppm	0.01 ppm		0.08 @ 25°C	1.7019 @ 25°C	YES	pungent 0.15 ppm	NE	NE	NE	NE	
2-Hexanone (methyl butyl ketone)	591786	5 ppm	5 ppm	5000 ppm	4 @ 77°F	0.81	YES	acetone-like odor		NE	NE	NE	9.39
Iron (soluble, dust)	7439896	1 mg/m ³	1 mg/m ³	NE	~0	7.88	NO		NE	NA	NA	NA	
Iodolin	465-73-6	NE	0.0007 (D)	NE	~0		YES		NE	NA	NA	NA	
Lead (inorganic)	7439821	0.05 mg/m ³	0.15 mg/m ³	700 mg/m ³	~0	11.34	NO	~odorless	IRIS B2	NA	NA	NA	
Magnesium (dust)	1309484	10 mg/m ³ T 5 mg/m ³ R	10 mg/m ³	NE	~0	3.58	NO		NE	NA	NA	NA	
Malathion	121-75-6	5 mg/m ³ R 10 mg/m ³ T	10 mg/m ³	5000 mg/m ³	~0	1.21	YES	skunk-like 13.5 mg/m ³	NE	NA	NA	NA	
Manganese	7439865	5 mg/m ³ C	5 mg/m ³	NE	~0	7.2	NO	~odorless	IRIS D	NA	NA	NA	
Mercury (vapor)	7439878	0.05 mg/m ³	0.05 mg/m ³	28 mg/m ³	0.0012	13.6	YES		IRIS D	NA	NA	NA	
Mercury (organo) alkyl compounds (as Hg)	7439876	0.01 mg/m ³ 0.03 mg/m ³ S	0.01 mg/m ³ 0.03 mg/m ³ S	10 mg/m ³	varies	varies	YES		IRIS D	NA	NA	NA	

mg/m³ = milligrams of contaminant per cubic meter of air

ppm = parts of contaminant per million parts of air

NE = Not Established

NA = Not Applicable

T = Total Dust

R = Respirable Dust

C = Ceiling Limit, shall not be exceeded at any time during the work day

S = Short Term Exposure Limit (STEL) usually 15 minutes, four times in one day

D = D, Value in mg/kg/day

S/6/2 = STEL for 5 minutes, twice in one day

a = These TLVs have not yet been adopted. ACGIH has placed them under notice of intended changes.

b = This PEL/TLV is for all Coal Tar Pitch Volatiles combined. Separate

PEL/TLVs have not been established to date

Carcinogenic Category

IRIS

IARC

A 1 Human Carcinogen

B1 2A Probable Human Carcinogen (limited human data)

B2 2B Probable Human Carcinogen (sufficient in animals, inadequate evidence in humans)

C 3 Possible Human Carcinogen

D 4 Not Classifiable

E Evidence of Non-Carcinogen

- OSHA = Occupational Safety and Health Administration
 ACGIH = American Conference of Governmental Industrial Hygienists
 IRIS = Integrated Risk Information System
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 PEL = Permissible Exposure Limit, unless noted is the TWA, Time Weighted Average (usually for 8 hours a day, 5 days a week), recommended by law
 TLV = Threshold Limit Value, unless noted is the TWA, Time Weighted Average (usually for 8 hours a day, 5 days a week), recommended by law
 IDLH = Immediately Dangerous to Life or Health
 Skin Hazard = Contaminant can be absorbed through intact skin.
 D, Value = Contaminant intake that should not induce adverse effects to human health or should not pose a risk of cancer occurrence greater than a predetermined risk level. Developed by US Army Medical Bioengineering Research and Development Laboratory

TABLE B-1
EXPOSURE LIMITS AND PROPERTIES OF COMPOUNDS DETECTED IN BASIN F LIQUIDS

COMPOUND	CAS #	OSHA PEL	ACGIH TLV/ D, VALUES	IDLH	VAPOR PRESS. in mm @ 68 F	SPEC. GRAVITY @ 68 F	SKIN HAZARD	ODOR THRESHOLD (PPM)	CARC CAT.	HNU % RESPONSE (BENZENE)		OVA % (METHANE) RESPONSE	IP (eV)
										10.2 eV	11.7eV		
Methyl Chloroform (1,1,1-Trichloroethane)	71556	360 ppm 450 ppm S	360 ppm 450 ppm S	1000 ppm	100	1.34	NO			NE	9	105	11.00
Methyl Ethyl Ketone (2-Butanone)	78933	200 ppm 300 ppm S	200 ppm 300 ppm S	3000 ppm	71	0.81	NO		IRIS D	5.7	6.3	80	9.54
Methylene Chloride	75092	500 ppm 1000 ppm C 2000 ppm S/5/2	500 ppm 1000 ppm C 2000 ppm S/5/2	5000 ppm	350	1.33	NO	sweet, pleasant 160 - 307 ppm	IRIS B2	NE	9.4	90	11.32
Methyl Isobutyl Ketone (Hexone) (4 methyl 2 pentanone)	108101	50 ppm 75 ppm S	50 ppm 75 ppm S	3000 ppm	18	0.8	NO		NE	5.7	10.6	100	9.30
Molybdenum (soluble)	7439887	5 mg/m ³	5 mg/m ³		varies		NO		NE	NA	NA	NA	
Nickel (soluble salts)	7440020	1 mg/m ³	1 mg/m ³ 0.05 mg/m ³ 34		~0	8.9	NO		IRIS A1 (refinery dust)	NA	NA	NA	
4-Nitrophenol	100-02-7	NE	NE		2.2 @ 147°C	1.27	YES	~odorless	NE	NA	NA	NA	
Parathion	56-38-2	0.1 mg/m ³	0.1 mg/m ³	20 mg/m ³	~0	1.27	YES	faint, garlic-like 0.470 mg/m ³	IRIS C	NA	NA	NA	
Potassium (dust)	7440087	10 mg/m ³ T 5 mg/m ³ R	10 mg/m ³	NE	1 @ 34.1°C	0.86				NA	NA	NA	
Styrene	205627	50 ppm 100 ppm S	50 ppm 100 ppm S	5000 ppm	5	0.91	YES	sweet, floral odor		9.7	NE	80	8.40
Supena (chlorofluorophos)	470-90-8	NE	0.00015 (D)	NE	~0	1.36 g/cm ³		mild odor		NA	NA	NA	
Toluene	108883	100 ppm 150 ppm S	50 ppm (a) 100 ppm 150 ppm S	2000 ppm	20 @ 65°F	0.87	YES	sweet pungent 2.14 ppm	IRIS D	10	10	110	8.82
Urea	57-13-6	NE	NE	NE	1.73 kPa @ 25°C	1.32	YES	odorless, ammonia-like in presence of moisture		NE	NE	NE	

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IRIS IARC

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EXPOSURE LIMITS AND PROPERTIES OF COMPOUNDS DETECTED IN BASIN F LIQUIDS

COMPOUND	CAS #	OSHA PEL	ACGIH TLV/ D ₁ VALUES	IDLH	VAPOR PRESS. in mm @ 68 F	SPEC. GRAVITY @ 68 F	SKIN HAZARD	ODOR THRESHOLD (PPM)	CARC CAT.	HNU % RESPONSE (BENZENE)	OVA % (METHANE) RESPONSE	IP (eV)
Vanadium	1314621	0.05 mg/m ³	0.05 mg/m ³	70 mg/m ³	-0	3.36	NO		NE	10.2 eV	11.7eV	NA
Vapors (dichlorovos)	62-73-7	1 mg/m ³	0.9 mg/m ³	200 mg/m ³	0.01 mm @ 86°F	1.42 @ 77°F	YES	mild, chemical odor	IRIS B2	NA	NA	12.20

Carcinogenic Category

IRIS	IARC
A	1
B1	2A
B2	2B
C	3
D	4
E	

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										10.2 eV	11.7 eV		
Xylene	(all isomers)	1330207			NA	NA			IRIS D	NE	NE	NE	
	o-	95478	100 ppm 150 ppm S	1000 ppm	7	0.88	NO			11.4	NE	118	8.58
	p-	108383			9	0.86				11.4	NE	116	8.58
	m-	106423			8	0.86				11.2	NE	111	8.44
Zinc (dust)	1314132	10 mg/m ³ T 5 mg/m ³ R	10 mg/m ³	NE	-0	5.61	NO		IRIS D	NA	NA	NA	

Carcinogenic Category

IRIS IARC

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ZERO ACCIDENTS

SECTION 01402

CHEMICAL DATA MANAGEMENT

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| 3. SAMPLING AND SAMPLE | 6. CALIBRATION PROCEDURES |
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| 4. ANALYTICAL | 7. PREVENTIVE MAINTENANCE |
| METHODS/PROCEDURES | 8. DATA ANALYSIS AND |
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ATTACHMENTS:

Table 1 - Field Screen Parameter List

Table 2 - Laboratory Analytical Methods List

1. **GENERAL REQUIREMENTS.** The Alternatives Evaluation Report (Woodward-Clyde Consultants 1992) describes the selection and recommendations to demonstrate the in situ dissolution of soluble solids present in tank 102 and subsequently to decontaminate the tank.

This Chemical Data Management Specification (CDMS) presents the requirements for data collection and management for the testing and monitoring of the dissolution product and the air emissions generated during the dissolution process.

No chemical analysis is anticipated to characterize the decontaminated tank liner, the containerized sludge (will be transferred directly to the Rocky Mountain Arsenal (RMA) waste management contractor), or the decontamination water generated during the decontamination process of the tank liner and the inside walls of the tank.

Based on previous sampling and bench-scale testing of the dissolution of Basin F crystals, contaminants of concern include the presence of ammonia and fugitive odor emissions e.g. volatile and semi-volatile organic compounds.

1.1. **ENVIRONMENTAL SAMPLING REQUIREMENTS.** This section describes the sampling and chemical analysis procedures to be performed during the in situ dissolution process of the Basin F crystals.

1.1.1. **Crystal Dissolution.** Grab samples of the dissolution product will be monitored during the dissolution process every two hours as well as collecting a duplicate grab sample for off-site testing at the completion of the process.

Field data will be used to evaluate the rate of Basin F crystal dissolution in the field and to evaluate feed requirements necessary to optimize operations of the submerged quench incinerator (SQI).

The purpose of collecting and analyzing the dissolution product by an off-site laboratory is for chemical characterization and to evaluate field measurements for accuracy and precision during the actual field operations.

Sample location, matrix, frequency, rational, and parameters are presented in Tables 1 and 2.

1.1.2. **Emission Control System.** Air monitoring in the field and for off-site laboratory analysis will be performed every two hours during field operations. Air samples for chemical analysis will be collected daily. The anticipated length of time for the in situ dissolution process is five days.

The purpose of monitoring the air emissions during the field operations is to qualitatively characterize the generated air emissions and to evaluate the removal efficiency of the in-line ammonia and granular activated carbon (GAC) scrubbing system.

The results of collecting air samples for additional analysis will be used to chemically characterize the air emissions generated during field operations and to evaluate the removal efficiency of the in-line ammonia and GAC scrubbing system.

Sample location, matrix, frequency, rational, and parameters are presented in Tables 1 and 2.

1.1.3. **Tank Interior Decontamination.** The tank liner material subsequent to decontamination and removal will be considered a hazardous material, therefore no chemical analyses will be required for disposal in a subtitle C landfill.

The Basin F sludge collected from the bottom of tank 102 will be containerized and then transferred to the Rocky Mountain Arsenal (RMA) waste management contractor. No chemical testing of the containerized sludge is anticipated.

The water generated during the decontamination process of the tank liner and tank interior will be containerized and transported to the RMA CERCLA waste water treatment facility. No chemical testing of the decontamination water is anticipated.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES. The Contractor shall submit, for approval by the Contracting Officer (CO), a Contractor Quality Control Plan (CQCP) including a Chemical Quality Control Section (CQCS) as outlined in this specification. The Contractor shall be responsible for providing the CQCS of the CQCP, which shall delineate the methods the contractor intends to use to accomplish the chemical quality control items as indicated in the specifications to assure data of acceptable accuracy, precision, representativeness, and comparability. Project-related qualifications of the Contractor's laboratory facilities and analytical instrumentation shall be described in detail. The CQCP must be reviewed and approved, by the CO or his representative, prior to the start of work. The Contractor will be responsible for the quality of all data produced by the Contractor's laboratory or subcontracted laboratories. The Contractor shall also develop and submit Standard Operating Procedures (SOP) for all repetitive tasks, e.g. sampling activities, routine equipment maintenance, etc.. Project management responsibilities shall be clearly defined in the CQCP along with a discussion of quality assurance/quality control (QA/QC) responsibilities.

2.1. **ORGANIZATION.** The project organization shall be described in the CQCP including the prime contractor and contractor-subcontractor interactions.

2.2. **KEY INDIVIDUALS AND RELATED EXPERIENCE.** Key personnel shall be identified and their function, responsibilities and qualifications to perform the tasks assigned shall be described. This description should include a comparison of the requirements of the job assignment with relevant experience and training of the prospective assignee including appropriate OSHA Health and Safety Training. It should also include an assessment of whether further training is required, and, if required, by what method the training will be accomplished.

2.3. **CONTRACTOR LABORATORY QUALIFICATIONS.** The Contractor shall inform the CO, as early as possible, which analytical laboratory will be used to perform the chemical analyses. The Contractor's designated lab shall submit a Laboratory Quality Management Plan (LQMP) and Laboratory Statement of Qualifications (SOQ) immediately upon designation of the laboratory to be utilized. CO or designee shall have final approval. The Contractor (or the subcontracted laboratory) shall be responsible for the following:

2.3.1. **Facilities and Personnel.** Provide all laboratory facilities and personnel qualified to perform the tasks to which they are assigned, and provide access to work, as required.

2.3.2. **Sample Handling.** Furnish labor, equipment,, and facilities to obtain and handle samples at the project site, to facilitate inspections and analyses, and to provide storage, preservation (including refrigeration) of the samples, as necessary.

2.3.3. **Sample Custody.** Ensure that transportation, chain of custody, and ultimate disposal of samples take place in accordance with USEPA procedures as referenced in USEPA Guidelines, USEPA SW-846 3rd. ed., or the

User's Guide to the Contract Laboratory Program. In the cases of soil samples or potentially contaminated water, the appropriate procedures will be used.

2.3.4. Data Management and Validation. The contractor's laboratory (or the subcontracted laboratory) shall employ a specific information management system to assist in tracking the progress of each sample through the analytical process. Analytical data shall undergo a data validation process that ensures that documentation is complete and correct, that any anomalies in the preparation and/or analysis of samples are documented, that sample holding times are documented, analytical results are correct and complete, QC samples are within established control limits, method blank procedures have been followed, and the data are ready for use.

2.3.5. Inspections, Sampling, and Analysis. The contractor's laboratory (or the subcontracted laboratory) shall comply with specified standards and methods for testing and analysis. The contractor shall ensure that field sampling, if performed by the laboratory, is performed in compliance with specified methods, and that the field instruments are properly calibrated. It is also required to ensure that sampling is performed in accordance with specified methods, that provisions are made to prevent sample contamination, and that samples are properly preserved.

2.3.6. Calibrations. The laboratory is required to perform initial and continuing instrument tuning and calibration of equipment to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established detection limits. Each instrument should be calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method. The frequency of calibration and the concentration of calibration standards is determined by the manufacturer's guidelines, the analytical method, and the requirements of special contracts.

2.3.7. Quality Assurance/Quality Control Samples. The laboratory will be required to analyze and report laboratory QA/QC samples including blanks, duplicates, and matrix spikes, and any additional QC requirements provided for in the specific analytical method or statement of work. The QA laboratory shall be a government laboratory, such as the Missouri River Division Laboratory. As part of the internal laboratory QC program, an analytical method blank should be analyzed with each batch of samples processed. Matrix duplicates should be prepared and processed separately for ten percent of the samples tested, or as a minimum, one duplicate per sample batch processed. The results of the matrix spike and matrix spike duplicate should be compared to assess the effects of the matrix on the precision of the analysis.

2.3.8. Sample Containers. Containers used for sample collection will be supplied by the testing laboratory that are documented as being certified clean and that contain the required preservatives, as appropriate. Soil samples should be collected in wide-mouth glass jars equipped with Teflon-lined screw caps. In general, environmental samples should be preserved by cooling with ice or refrigeration at 4°C. No chemical preservative should be added to air matrix samples.

2.3.9. Recordkeeping. Maintain internal recordkeeping, in accordance with good laboratory practices (GLP), as referenced in 40 CFR 792.

2.3.10. Chain of Custody. Follow chain of custody requirements in accordance with USEPA protocols as referenced in National Enforcement Investigations Center, "Enforcement Consideration For Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors", Draft, dated April 1980. In the case of potentially contaminated water, the appropriate approved protocols will be used. As a minimum, each sample set will include a chain-of-custody (COC) form transmitting the samples to the laboratory. The sample custodian at the laboratory will accept custody of the samples and verify that the information on the sample labels matches that on the COC records. The custodian will then enter the appropriate data, including sampling date, time of receipt, and cooler temperature on the COC form, and in the laboratory sample tracking system, as applicable. A laboratory identification number will be assigned to each sample. The custodian will then either transfer the sample to the analyst or store the sample in an appropriate storage area. The COC procedures will track the sample

from receipt through the laboratory system until the analytical process is complete and the sample is back in the custody of the lab custodian. Samples and extracts shall be retained by the laboratory for a period of sixty days after the written report is issued by the laboratory. Final disposition of all samples and extracts shall be documented and a certified copy of the COC form shall be included with the analytical data.

3. CONTRACTOR SAMPLING AND SAMPLE CUSTODY PROCEDURES

3.1. GENERAL. Sampling activities shall be performed according to protocols specific to each parameter of interest, promulgated by the USEPA and referenced in Test Methods for Evaluating Solid Waste (SW-846), Third Edition, 1986, 40 CFR 60 Appendix A, and 40 CFR 61 Appendix B. Where such protocols have not been established by the USEPA, protocols established by some other recognized authority (e.g. American Society of Testing and Materials, National Institute of Occupational Safety and Health, etc.) shall be utilized following approval by the CO or designee. The CQCP shall fully describe all sampling procedures including those below.

3.2. SAMPLING AND CUSTODY PARAMETERS

3.2.1. Sample Site Selection. The contractor shall provide a rationale for the proposed selection of sampling sites, as well as details concerning the method of site selection (location, historical data, etc.). Final approval shall be given by the CO or designee.

3.2.2. Sampling Procedures. The contractor shall furnish all information relative to the sampling process, including equipment used, sample volume, and sampling technique. The contractor shall supply all references to the procedures used.

3.2.3. Sample Containers and Cleaning Procedures. The types of sample containers used shall be consistent with USEPA requirements for the specific parameters of interest as referenced in USEPA, Office of Solid Waste and Emergency Response, SW-846, and in USEPA, National Enforcement Investigations Center, "Enforcement Consideration for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors", Draft, dated April 1980.

3.2.4. Procedures Employed to Avoid Sample Contamination. During sampling activities, appropriate decontamination measures shall be taken to minimize sample contamination from external sources such as sampling equipment. These procedures shall be consistent with those outlined in SW-846, or with approved procedures in the case of potentially contaminated water. The sampling program established for this project shall include provisions for generating the appropriate field QA/QC samples to monitor the effectiveness of the specific procedures employed in controlling external contamination.

3.2.5. Sample Preservation. Samples collected shall be preserved according to USEPA protocols established for the parameters of interest as referenced in SW-846. Appropriate measures shall be taken to ensure that storage requirements with respect to temperature are maintained during transport to the laboratory, and prior to log-in and storage at the laboratory. In general, hazardous samples (those which contain medium or high concentrations of contaminants) should not be fixed with any chemical preservative nor cooled. Environmental samples should be cooled by ice or refrigeration to maintain the sample temperature near 4°C.

3.2.6. Sample Transportation. Samples shall be transported to the contractor laboratory via the most rapid means taking into account any holding time requirements. Samples shall be packaged and transported according to USEPA, CO, and Department of Transportation (DOT) regulations. These procedures are referenced in Code of Federal Regulations, Title 49 (Transportation), Parts 172 and 173; and National Enforcement Investigations Center (NEIC), "Enforcement Considerations for Evaluation of Uncontrolled Hazardous Waste Disposal Sites by Contractors", draft, dated April 1980.

3.2.7. Chain of Custody Procedures. Samples shall be collected, transported, and received under strict COC protocols consistent with procedures established by the USEPA for litigation related materials as referenced in 2.3.10. In the cases of pretest soil/sludge samples or potentially contaminated water, the appropriate approved protocols will be followed. Upon receipt at the

laboratory, the laboratory shall provide a specific mechanism through which the disposition and custody of the samples are accurately documented during each phase of the analytical process. As a minimum, a COC form will be filled out and will accompany every shipment of samples to the analytical laboratory. The COC form will contain the following information:

- 3.2.7.1. Sample number or sample I.D.
- 3.2.7.2. Signature of the sampler or collector
- 3.2.7.3. Date and time of collection
- 3.2.7.4. Sample type
- 3.2.7.5. Type of analyses requested
- 3.2.7.6. Signatures of persons involved in the chain of

possession

- 3.2.7.7. Number of containers
- 3.2.7.8. Preservatives (as appropriate)
- The laboratory shall record the following information on the COC form:
- 3.2.7.9. Name of persons receiving sample
- 3.2.7.10. Date and time of sample receipt
- 3.2.7.11. Sample condition
- 3.2.7.12. Temperature of cooler upon receipt

The originals will follow the sample to its final destination and copies documenting each custody change will be received and kept on file by the quality assurance manager. samples and extracts shall be retained by the laboratory for a period of sixty days after the written report is issued by the laboratory. COCs will be maintained until final disposition of the samples.

3.2.8. **Sample Information Documentation.** Information pertinent to the environmental samples, including sample descriptions, specific field collection data, and laboratory observations shall be recorded in permanently bound notebooks. The contractor laboratory shall also employ a specific information management system to assist in tracking the progress of each sample through the analytical process.

4. **ANALYTICAL METHODS/PROCEDURES.** Analytical methods presented in Table 2 shall be utilized for the project unless otherwise approved by the CO or designee. USEPA methods have been specified for the testing and analysis of soil and water samples collected during the installation, operation and management of the remedial alternatives. NIOSH methods, with modifications as appropriate, have been specified for the testing and analysis of air samples collected during the operation and maintenance of the remedial alternatives.

The CQCS of the CQCP shall specifically state the analytical procedures to be used. Other properly validated and standardized methods may be substituted subject to the CO's approval. The contractor shall describe possible interferences based on the methods of analysis, matrixes involved, and chemicals known to be present and shall describe methods of compensating for the interferences identified in the CQCP. Sensitivity and detection limits of the methods must be sufficient for the purpose of the analyses. At the end of the project, the contractor shall, at the CO's option, submit a copy of all analytical data including log books, chromatograms, instrument outputs, and calculations.

5. **ANALYTICAL/STATISTICAL/CONTROL PARAMETERS.**

5.1. **ACCURACY.** Accuracy is a measure of the bias in a system and can be defined as the degree of agreement of a measurement with the accepted reference or true value. Although the exact bias of a system can never be known, inferences can be drawn from an examination of blank analysis and laboratory spiked analysis. Accuracy will be evaluated through the collection and analysis of matrix spike samples. Five percent of the samples collected shall be collected in sufficient quantity such that a matrix spike can be generated in addition to an aliquot reserved for actual sample analysis. The matrix spike sample shall be fortified with a series of method target compounds, while a second aliquot of the sample shall be analyzed unfortified. Accuracy shall be measured in terms of percent recovery of each of the fortified components in

accordance with the method specified. Control limits shall be established in the CQCP.

5.2. SENSITIVITY. The sensitivity of each analytical method employed shall be determined according to protocols established in SW-846. Method detection limits determined in this manner shall be equivalent to those provided in each of the specific analytical methods. In the cases of soil samples or potentially contaminated water, appropriate and approved protocols will be followed.

5.3. PRECISION. Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. The measurement of precision is made through the use of duplicate or replicate samples, taken at regular intervals. Sampling precision will be evaluated through the collection and analysis of field duplicate samples. Field duplicates shall be collected at a frequency of one per matrix type. The relative percent difference between each sample and duplicate shall be calculated, and used as a measure of sampling precision. Control limits used shall be specified in the CQCP.

5.4. CONTRACTOR INTERNAL QC CHECKS. The Contractor shall, at a minimum, analyze internal QC samples at a frequency of 10 percent. These QC samples shall include duplicates, method blanks, external reference samples, and laboratory control samples. In addition, field blanks and reinstates shall be analyzed at a frequency of 20 percent. Trip blanks shall accompany all volatile samples and shall be analyzed at a frequency of 10 percent. A specific system detailing the protocols to be followed in the event that any internal QC check sample does not meet laboratory acceptance criteria shall be implemented. This system shall include the mechanism by which corrective action taken in the event of any non-conformance event is documented and assurance provided that system in question remains in control.

5.5. FIELD QA/QC SAMPLES. Field duplicate/split samples to be analyzed by both the contractor laboratory and the QA laboratory shall be collected at a frequency of one per matrix type for each ten field samples collected. The results from the subcontractor laboratory for such samples shall be reported in a timely manner to the CO for comparison to the QA laboratory's results. It is the responsibility of the CO to report any significant discrepancies between these two results to the Contractor laboratory. In the event of such an occurrence, the Contractor's laboratory shall initiate an investigation into possible reasons for the discrepancy, and submit a plan to resolve the problem. All such activities shall be considered as non-conformance events, and be supported by the appropriate documentation.

5.6. REPRESENTATIVENESS. Representativeness is the degree to which a set of data accurately represents the characteristics of a population, a process condition, or an environmental condition. Data are usually considered representative if the sample distribution is within statistically defined bounds. Representativeness should be defined in the CQCP. For field sample collection, it is the responsibility of the sampling team to conduct their activities such that representativeness is ensured when field duplicates or split samples are collected. This includes the use of appropriate sample homogenization procedures, that do not interfere with the particular parameters of interest, to ensure that each duplicate/split sample will be representative of the whole sample. Laboratory procedures shall be established to ensure that aliquots used for sample analysis are representative of the whole sample. Similarly, any such procedures employed at the laboratory level shall not interfere with the concentration or composition of the analysis in the sample.

5.7. DATA COMPARABILITY. Comparability expresses the confidence with which one data set can be compared with another. The contractor laboratory shall make the necessary provisions to ensure the comparability of all data. These procedures include, but are not limited to, the use of standard approved methodologies, the use of standard units, and report format, the use of calculations as referenced in the methodology for quantification, and the use of standard measures of accuracy and precision for quality control samples.

6. CALIBRATION PROCEDURES AND FREQUENCIES. A list of field and laboratory instrumentation (including details on manufacturer, models, accessories, etc.) procedures used for calibration and frequency of checks are required. The instrumentation and calibrations shall be consistent with the requirements of the contract, the USEPA approved analytical method requirements, and the manufacturer's guidelines. Calibration procedures and certification documents shall be submitted to the CO. Primary reference standards and standard solutions should be obtained from the National Institute of Standards and Technology, the USEPA Repository, or other reliable commercial sources. Standard solutions used in analytical operations should be validated prior to use. Validation procedures can range from a check for chromatographic purity to verification of the concentration of the standard using a standard prepared at a different time or obtained from a different source. Reagents are examined for purity by subjecting an aliquot or subsample to the analytical method corresponding as well. Information on laboratory instrumentation and calibration procedures can be referenced to the LQMP instead of repeating it in the CQCP. In the cases of soil samples or potentially contaminated water, appropriate and approved calibration procedures and frequencies will be followed.

7. PREVENTIVE MAINTENANCE. A preventive maintenance program for all facilities and instrumentation used by the contractor for sampling and analyses shall be presented in the CQCS of the CQCP. The Contractor's laboratory shall maintain a bound logbook for each analytical instrument. This book serves as a permanent record documenting any routine preventive maintenance performed, as well as any service performed by external individuals such as manufacturer's service representatives. All maintenance activities shall be performed by individuals qualified to perform the particular task involved. All records shall be made available for inspection upon request. To the extent that preventive maintenance is covered in the LQMP, this information can be reference by the CQCP instead of repeating it in the CQCP.

8. DATA ANALYSIS AND REPORTING. Reports shall include the validated results obtained from the analysis of samples, all pertinent data obtained from the analysis of both internal and external quality control samples, including, but not limited to, actual detection limits, surrogate spike data, matrix spike data, and method blank results. The Contractor shall provide in the CQCS of the CQCP for each analytical method and major measurement parameter the following:

8.1. CALCULATIONS. The contractor shall provide, for each analytical method, detail regarding the data analysis scheme including units and equations required to calculate concentrations or the value of the measured parameter.

8.2. PROCEDURES TO ENSURE DATA INTEGRITY. The contractor shall identify the principle QC acceptance criteria used to assure data integrity during collection and reporting. The means of establishing these criteria shall be identified in the CQCP, as well as procedures implemented to provide corrective action when data do not meet acceptance criteria.

8.3. TREATMENT OF OUTLIERS. The Contractor shall describe the specific mechanisms employed by which outlier data are identified. Details provided shall include a description of the phase of the analytical process where these mechanisms are employed, and the process by which subsequent decisions regarding the disposition of the outlier data in question are made.

8.4. DATA MANAGERMENTS. The contractor shall provide detailed information regarding the handling of data, including the types and mechanisms of review processes and the qualifications of the various individuals involved in this activity.

8.5. DOCUMENTATION. The contractor shall describe the specific procedures employed to archive data including a description of any hardware involved (computers, etc.). Handling and storage procedures for all raw data and QC sample data shall also be described.

9. CONTRACTOR REPORTS.

9.1. CONTRACTOR QUALITY CONTROL SECTION (CQCS) OF THE CONTRACTOR QUALITY CONTROL PLAN (CQCP). The major items and organization of the CQCS includes project specific detail and shall include specific sampling points and rationale for selection of these sites, specific sampling procedures, specific packaging and chain-of custody procedures, specific analytical protocols, and specific control limits (acceptance criteria) to be employed by the validated contract laboratories. The CQCS shall contractually delineate details for accomplishing the chemical quality control items as directed in these specifications. The CQCS shall assure accurate, precise, complete and comparable data. External operations involving Government-Contractor intentions shall also be incorporated in the CQCS. The CQCS of the CQCP should include information as outlined in paragraphs 9.3.1 through 9.3.8 of this section.

9.2. DAILY QUALITY CONTROL REPORTS (DQCR). The Contractor shall prepare daily a report on each day of the project. Information contained in this report shall include, as a minimum (a) location of the work, (b) weather conditions, (c) work performed, (d) results of inspections performed, (e) problems identified and associated corrective actions taken, including any QA/QC problems encountered, (f) any instruction received from government personnel for retesting (e.g., QA samples), (g) types of tests performed, the individuals performing the tests, and subsequent results, (h) general comments, (i) calibration procedures and recordings, and (j) the contractor's certification.

9.3. CONTRACTOR QUALITY CONTROL SUMMARY REPORT. A report summarizing the items discussed above for the operating period shall be prepared by the contractor. This report shall be prepared by compiling information relative to the project according to the following outline:

- 9.3.1. Project Scope
- 9.3.2. Project Description
- 9.3.3. Sampling Procedures
- 9.3.4. Summary of Daily QC Reports (DQCR)
- 9.3.5. Analytical Procedures
- 9.3.6. Data Presentation
- 9.3.7. Quality Control Activities
- 9.3.8. Conclusions and Recommendations. (Include any pertinent

observations made during this project that are of use to future site activities).

TABLE 1
FIELD SCREEN PARAMETERS LIST

PARAMETER	REQUIRED PORTABLE INSTRUMENTATION	MATRIX	SOURCE	RATIONAL	SAMPLING FREQUENCY
Temperature	Thermocouple/meter	water	Sampling port-tank 102	Monitor temperature	Every 2 hours during dissolution process
Specific Conductance	Conductivity meter and electrode	water	Sampling port-tank 102	Monitor solids content	Every 2 hours during dissolution process
pH	pH meter and electrode	water	Sampling port-tank 102	Monitor pH	Every 2 hours during dissolution process
Density	Field hydrometer	water	Sampling port-tank 102	Monitor density	Every 2 hours during dissolution process
Turbidity	Spectrophotometer	water	Sampling port-tank 102	Monitor solids content	Every 2 hour during dissolution process
Organic vapor	Organic vapor analyzer	air	Sampling port-tank 102	Monitor volatile organics	Every 2 hours during dissolution process
Ammonia	Draeger tubes	air	Sampling port-tank 102	Monitor ammonia	Every 2 hours during dissolution process

TABLE 2
LABORATORY ANALYTICAL METHODS LIST

ANALYTICAL METHOD	METHOD NUMBER	MATRIX	REFERENCE	SOURCE	SAMPLING FREQUENCY
GC/MS Volatiles	8240 T0-1/8240	water air	SW-846 USEPA	A, B, C, and D	ONE DUPLICATE DAILY FOR 5 DAYS
GC/MS Semivolatiles	8270 T0-4/8270	water air	SW-846 USEPA	A, B, C, and D	ONE DUPLICATE DAILY FOR 5 DAYS
Pesticides/PCBs	8080	water	SW-846	A	DAILY FOR 5 DAYS
ICP Metals	3005/6010	water	SW-846	A	DAILY FOR 5 DAYS
Mercury	7470/7471	water	SW-846	A	DAILY FOR 5 DAYS
Selenium	270.3/7741	water	SW-846	A	DAILY FOR 5 DAYS
Common Anions	300.0	water	SW-846	A	DAILY FOR 5 DAYS
Total Kjeldahl Nitrogen	351	water	SW-846	A	DAILY FOR 5 DAYS
Total Dissolved Solids	160.1	water	SW-846	A	DAILY FOR 5 DAYS
Total Suspended Solids	160.2	water	SW-846	A	DAILY FOR 5 DAYS
Specific Conductance	120.1	water	SW-846	A	DAILY FOR 5 DAYS
BTU Content	D2382	water	ASTM	A	DAILY FOR 5 DAYS
Specific Gravity	D1429	water	ASTM	A	DAILY FOR 5 DAYS

A-(water matrix)/sampling port on tank 102
B-(air matrix)/sampling port prior to air scrubbers
C-(air matrix)/sampling port after ammonia scrubber
D-(air matrix)/sampling port after GAC scrubber leading to atmosphere

August 1991

ZERO ACCIDENTS

**SECTION 01430
ENVIRONMENT PROTECTION**

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| 3. PRECONSTRUCTION SURVEY | 10. EROSION CONTROL |
| 4. PROTECTION OF LAND AREAS | 11. CORRECTIVE ACTION |
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| 6. PROTECTION OF WATER RESOURCES | OBLITERATION |
| 7. WASTE DISPOSAL | |

1. **GENERAL.** The Contractor shall perform all work in such manner as to minimize the polluting of air, water, or land, and shall, within reasonable limits, control noise and the disposal of solid waste materials, as well as other pollutants.

2. **IMPLEMENTATION.** Within 20 calendar days after Notice to Proceed and prior to commencement of the work at the site, the Contractor shall:

2.1. Submit in writing his detailed proposal for implementing the requirements for environmental pollution control specified herein.

2.2. Meet with representatives of the Contracting Officer to review and alter his proposal as needed for compliance with the environmental pollution control program.

3. **PRECONSTRUCTION SURVEY.** Prior to start of any on-site construction activities, the Contractor and the Contracting Officer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs and grassed areas immediately adjacent to the site of the work and adjacent to his assigned storage area and access route(s) as applicable. This report will be signed by both the Contracting Officer and Contractor upon mutual agreement as to its accuracy and completeness.

4. **PROTECTION OF LAND AREAS.** Except for any work or storage area and access routes specifically assigned for the use of the Contractor under this contract, the land areas outside the limits of permanent work performed under this contract shall, in accordance with: "Protection of Existing Vegetation, Structures, Utilities and Improvements," be preserved in their present condition. Contractor shall confine his construction activities to areas defined for work on the plans or specifically assigned for his use. In accordance with: "Operations and Storage Areas," storage and related areas and access routes required temporarily by the Contractor in the performance of the work will be assigned by the Contracting Officer. No other areas on Government premises shall be used by the Contractor without written consent of the Contracting Officer.

5. **PROTECTION OF TREES AND SHRUBS.** "Protection of Existing Vegetation, Structures, Utilities and Improvements," is hereby supplemented as follows: Except for trees or shrubs marked on the plans to be removed, the Contractor shall not deface, injure or destroy trees or shrubs, nor remove or cut them without special authority. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages.

5.1. **TREE PROTECTIVE STRUCTURES.** Where, in the opinion of the Contracting Officer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his other operations, he may direct the

Contractor to provide temporary protection of such trees by placing boards, planks, or poles around them.

5.2. RESTORATION OF DAMAGED TREES. Any tree scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense. All scars made on trees not designated on the plans to be removed by construction operations shall be coated as soon as possible with an approved tree wound dressing. Trees that are to remain, either within or outside established clearing limits, that are damaged by the Contractor so as to be beyond saving in the opinion of the Contracting Officer, shall be immediately removed, if so directed, and replaced with a nursery-grown tree of the same species and size.

6. PROTECTION OF WATER RESOURCES. The Contractor shall control the disposal of fuels, oils, bitumens, calcium chloride, acids or harmful materials, both on and off the Government premises and shall comply with applicable Federal, State, County and Municipal laws concerning pollution of rivers and streams while performing work under this contract. Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, herbicides, and insecticides from entering public waters. Water used in on-site material processing, concrete curing, foundation and concrete cleanup, and other waste waters shall not be allowed to reenter a stream if an increase in the turbidity of the stream could result therefrom.

7. WASTE DISPOSAL. As part of his proposed implementation under paragraph 2, and prior to on-site construction, the Contractor shall submit a description of his scheme for disposing of waste materials resulting from the work under this delivery order. If any waste material is dumped in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed areas. Where directed, contaminated ground shall be excavated, disposed of as approved, and replaced with suitable fill material, all at the expense of the Contractor.

8. BURNING. Air pollution restrictions applicable to this project are as follows. Material shall not be burned on the Government premises. If the Contractor elects to dispose of waste materials off the Government premises, by burning, he shall make his own arrangements for such burning area and shall, as specified in: "Permits and Responsibilities," conform to all local regulations.

9. DUST CONTROL. The Contractor shall maintain all excavations, embankments, stockpiles, access roads, waste areas, and all other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to the Using Service or to others. Approved temporary methods consisting of sprinkling, chemical treatment, or similar methods will be permitted to control dust. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

10. EROSION CONTROL. Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall be graded to control erosion within acceptable limits. Temporary control measures shall be provided and maintained until permanent drainage facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum.

11. CORRECTIVE ACTION. The Contractor shall, upon receipt of a notice in writing of any noncompliance with the foregoing provisions, take immediate corrective action. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs of damages by the Contractor unless it was later determined that the Contractor was in compliance.

12. **POST-CONSTRUCTION CLEANUP OR OBLITERATION.** In accordance with: "Cleaning Up," the Contractor shall, unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed areas shall be graded and filled and the entire area seeded.

November 1991

SECTION 01440

CONTRACTOR QUALITY CONTROL
01/91

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

ATTACHMENTS: Daily Quality Control Report

1. GENERAL.

1.1. SUMMARY (NOT APPLICABLE).

1.2. REFERENCES. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM D 3740 (1988) Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329 (1990) Use in the Evaluation of Testing and Inspection Agencies as Used in Construction

1.3. PAYMENT. Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

2. PRODUCTS (NOT APPLICABLE).

3. EXECUTION.

3.1. GENERAL. The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the delivery order requirements. The system shall cover all construction operations, both on-site and off-site, and shall be keyed to the proposed construction sequence.

3.2. QUALITY CONTROL PLAN.

3.2.1. General. The Contractor shall furnish for review by the Government, not later than 10 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2. Content of the CQC Plan. The CQC plan shall include, as a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers and purchasing agents:

3.2.2.1. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC system manager who shall report to the Project Manager or someone higher in the Contractor's organization.

Project Manager in this context shall mean the individual with responsibility for the overall management of the project including quality and production.

3.2.2.2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.

3.2.2.3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC system manager including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to the Government.

3.2.2.4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers and purchasing agents. These procedures shall be in accordance with Section 01305 SUBMITTAL PROCEDURES.

3.2.2.5. Control, verification and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

3.2.2.6. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

3.2.2.7. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

3.2.2.8. Reporting procedures, including proposed reporting formats.

3.2.2.9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3. Acceptance of Plan. Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4. Notification of Changes. After acceptance of the QC plan, the Contractor shall notify the Contracting Officer in writing a minimum of seven calendar days prior to any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3. COORDINATION MEETING. After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the Quality Control Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both on-site and off-site work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the delivery order file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4. QUALITY CONTROL ORGANIZATION.

3.4.1. CQC System Manager. The Contractor shall identify an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This CQC System Manager shall be on the site at all times during construction and will be employed by the Contractor, except as noted in the following. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the system manager's absence. Period of absence may not exceed 2 weeks at any one time, and not more than 30 workdays during a calendar year. The requirements for the alternate will be the same as for the designated CQC manager.

3.4.2. CQC Organizational Staffing. The Contractor shall provide a CQC staff which shall be at the site of work at all times during progress, with complete authority to take any action necessary to ensure compliance with the contract.

3.4.2.1. CQC Staff. Following are the minimum requirements for the CQC staff. These minimum requirements will not necessarily assure an adequate staff to meet the CQC requirements at all times during construction. The actual strength of the CQC staff may vary during any specific work period to cover the needs of the work period. When necessary for a proper CQC organization, the Contractor will add additional staff at no cost to the Government. This listing of minimum staff in no way relieves the Contractor of meeting the basic requirements of quality construction in accordance with delivery order requirements. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2.2. CQC System Manager. The CQC system manager shall be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 2 years construction experience on similar type construction to this delivery order. An experienced construction person with a minimum of 5 years experience in related work. The CQC system manager shall be assigned no other duties as system manager but may have duties as project superintendent in addition to quality control.

3.4.3. Organizational Changes. The Contractor shall obtain Contracting Officer's acceptance before replacing any member of the CQC staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

3.5. SUBMITTALS. Submittals shall be as specified in Section 01305 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the delivery order requirements.

3.6. CONTROL. Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the delivery order. The controls shall be adequate to cover all construction operations, including both on-site and off-site fabrication, and will be keyed to the proposed construction sequence. The controls shall include at least three phases of control to be conducted by the CQC system manager for all definable features of work, as follows:

3.6.1. Preparatory Phase. This phase shall be performed prior to beginning work on each definable feature of work and shall include:

3.6.1.1. A review of each paragraph of applicable specifications.

3.6.1.2. A review of the scope of work plans.

3.6.1.3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

3.6.1.4. A check to assure that provisions have been made to provide required control inspection and testing.

3.6.1.5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the scope of work.

3.6.1.6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawing or submitted data, and are properly stored.

3.6.1.7. A review of the appropriate activity hazard analysis to assure safety requirements are met.

3.6.1.8. Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that phase of work.

3.6.1.9. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

3.6.1.10. The Government shall be notified at least 48 hours in advance of beginning any of the required action of the preparatory phase. This phase shall include a meeting conducted by the CQC system manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC system manager and attached to the daily QC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet delivery order specifications.

3.6.2. Initial Phase. This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

3.6.2.1. A check of preliminary work to ensure that it is in compliance with scope of work requirements. Review minutes of the preparatory meeting.

3.6.2.2. Verification of full scope of work compliance. Verify required control inspection and testing.

3.6.2.3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with sample panels as appropriate.

3.6.2.4. Resolve all differences.

3.6.2.5. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

3.6.2.6. The Government shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC system manager and attached to the daily QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

3.6.2.7. The initial phase should be repeated for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

3.6.3. Follow-up Phase. Daily checks shall be performed to assure continuing compliance with delivery order requirements, including control testing, until completion of the particular feature of work. Each check performed shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

3.6.4. Additional Preparatory and Initial Phases. Additional preparatory and initial phases may be conducted on the same definable features of work as determined by the Government if the quality of on-going work is unacceptable; or if there are changes in the applicable QC staff or in the on-site production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7. TESTS

3.7.1. Testing Procedure. The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to delivery order requirements. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. A list of tests to be performed shall be furnished as a part of the CQC plan. The list shall give the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of

the number of tests required. The Contractor shall perform the following activities and record and provide the following data:

3.7.1.1. Verify that testing procedures comply with delivery order requirements.

3.7.1.2. Verify that facilities and testing equipment are available and comply with testing standards.

3.7.1.3. Check test instrument calibration data against certified standards.

3.7.1.4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

3.7.1.5. Results of all tests taken, both passing and failing tests, will be recorded on the Quality Control report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. Actual test reports may be submitted later, if approved by the Contracting Officer, with a reference to the test number and date taken. An information copy of tests performed by an off-site or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports, as stated, may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2. Testing Laboratories.

3.7.2.1. **Capability Check.** The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the scope of work specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2. **Capability Rerecheck.** If the selected laboratory fails the capability check, the Contractor will be assessed the actual cost for the rerecheck to reimburse the Government for each succeeding rerecheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the delivery order amount due the Contractor.

3.7.3. **On-Site Laboratory.** The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4. **Furnishing or Transportation of Samples for Testing.** Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail: 420 S. 18th Street
Omaha, Nebraska 68102-2586

For other deliveries: Same as above

Coordination for each specific test, exact delivery location and dates will be made through the Resident Office.

3.8. **COMPLETION INSPECTION.** At the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC system manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved plans and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC system manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Government. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular

increment thereof if the project is divided into increments by separate completion dates.

3.9. DOCUMENTATION. The Contractor shall maintain current records of quality control operations, activities, and tests performed, including the work of subcontractors and suppliers. These records shall be on an acceptable form and shall include factual evidence that required quality control activities and/or tests have been performed, including but not limited to the following:

3.9.1. Contractor/subcontractor and their area of responsibility.

3.9.2. Operating plant/equipment with hours worked, idle, or down for repair.

3.9.3. Work performed today, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

3.9.4. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.

3.9.5. Material received with statement as to its acceptability and storage.

3.9.6. Identify submittals reviewed, with delivery order reference, by whom, and action taken.

3.9.7. Off-site surveillance activities, including actions taken.

3.9.8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

3.9.9. List instructions given/received and conflicts in plans and/or specifications.

3.9.10. Contractor's verification statement.

3.9.11. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the scope of work. The original and one copy of these records in report form shall be furnished to the Contracting Officer's Representative on the first work day following the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the delivery order. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC system manager. The report from the CQC system manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.10. SAMPLE FORMS. Sample forms enclosed at the end of this section.

3.11. NOTIFICATION OF NONCOMPLIANCE. The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

4. Control Activities Performed:

Preparatory Inspections: (Identify feature of work and attach minutes).

Initial Inspections: (Identify feature of work and attach minutes).

Follow-Up Inspections: (List inspections performed, results of inspection compared to specification requirements, and corrective actions taken when deficiencies are noted).

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5. Tests Performed and Test Results: (Identify test requirement by paragraph number in specifications and/or sheet number in plans).

6. Material Received: (Note inspection results and storage provided).

7. Submittals Reviewed:

(a) Submittal No.	(b) Spec/Plan Reference	(c) By Whom	(d) Action
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8. Offsite Surveillance Activities, Including Action Taken:

[illegible]

9. Job Safety: (List items checked, results, instructions and corrective actions taken).

10. Remarks: (Instructions received or given. Conflict(s) in Plans and/or specifications. Delays encountered.).

Contractor's Verification: On behalf of the Contractor, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

CQC System Manager

Date

ZERO ACCIDENTS

SECTION 01450

SPILL CONTROL

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SCOPE OF WORK.

1.1.1. The Contractor shall develop, implement, maintain, supervise, and be responsible for a comprehensive Spill and Discharge Control Plan. This plan will provide contingency measures for potential spills and discharges for contaminated soil, chemicals and off-site transportation. The Spill and Discharge Control Plan shall be submitted to and approved by the Contracting Officer in accordance with Submittals, of Section 01100, SPECIAL CLAUSES, paragraph 4 - Submittals. The Contractor shall review and coordinate his spill and Discharge Control Plan with RMA's Spill Prevention Control and Countermeasures Plan.

1.1.2. The Contractor shall provide methods, means, and facilities required to prevent contamination of soil, water, atmosphere, uncontaminated structures, equipment, or material by the discharge of wastes from spills due to the Contractor's operations.

1.1.3. The Contractor shall provide equipment and personnel to perform emergency measures required to contain any spilled materials and to remove spilled materials, soils or liquids that become contaminated due to spillage. This collected spill material shall be properly disposed of at the Contractor's expense. This includes spillage during sludge excavation, liquid removal, and equipment and personnel decontamination.

1.1.4. The Contractor shall provide equipment and personnel to perform decontamination measures that may be required resulting from the removal of spillage from previously uncontaminated structures, equipment, material, or existing ground. Decontamination residues shall be properly disposed of at the Contractor's expense.

1.2. SUBMITTALS.

1.2.1. In accordance with Section 01100 SPECIAL CLAUSES, paragraph 4 - Submittals and Section 01305 SUBMITTAL PROCEDURES, the Contractor shall submit information as specified herein on the following:

1.2.2. SD06 Instruction. Spill and Discharge Control Plan. For further description of submittals: See Section 01300 SUBMITTALS.

2. PRODUCTS.

2.1 EQUIPMENT REQUIRED. The Contractor shall provide for any unexpected spills or discharges through provision of the following minimum equipment items to be kept on-site at all times during site work activities:

2.1.1. Sand, clean fill, or other noncombustible absorbent materials.

2.1.2. Front-end loader.

- 2.1.3. Barrels (55 gallon, U.S. 17-E or 17-H)
- 2.1.4. Shovels
- 2.1.5. Solvent for decontamination of tools and equipment.

3. EXECUTION.

3.1. SPILL AND DISCHARGE CONTROL PLAN.

3.1.1. Spills. If a spill occurs, the following actions shall be taken by the Contractor:

3.1.1.1. Notify the Contracting Officer immediately.

3.1.1.2. Take immediate measures to control and contain the spill within the site boundaries. This shall include the following actions:

3.1.1.2.1. Keep unnecessary people away, isolate hazardous areas, and deny entry.

3.1.1.2.2. Do not allow anyone to touch spilled material.

3.1.1.2.3. Stay upwind; keep out of low areas.

3.1.1.2.4. Keep combustibles away from the spilled material.

3.1.1.2.5. Use water spray, if appropriate, to reduce vapors, as needed.

3.1.1.2.6. Other actions, as needed.

3.1.1.3. The Contractor shall implement general spill control actions as follows:

3.1.1.3.1. Solid Spills: Remove and place contaminated materials into 55-gallon poly-drums.

3.1.1.3.2. Liquid and/or Sludge Spills: Absorb with sand, clean fill, or other noncombustible absorbent material. Dispose of the absorbent/spill mixture in the manner specified in subparagraph 3.1.1.3.1 of this section.

3.1.2. Discharges. If a discharge of material stored in an impoundment, tank or container occurs, the following actions shall be taken by the Contractor to reduce potential migration to adjacent properties.

3.1.2.1. Notify the Contracting Officer immediately.

3.1.2.2. Take immediate measures to control the discharge within the site boundaries or beyond the site boundaries, if necessary. This shall include the following actions:

3.1.2.2.1. Contain and eliminate the discharge, if possible.

3.1.2.2.2. Remove or retrieve any discharged liquids or sludges, if possible.

3.1.2.2.3. Keep unnecessary people away; isolate the hazardous area and deny entry.

3.1.2.2.4. Do not allow anyone to come into contact with the discharge materials.

3.1.2.2.5. Other actions as needed.

3.1.2.3. General Discharge control actions the Contractor shall implement are as follows:

3.1.2.3.1. Liquid and/or Sludge Discharges to Soil: Immediately identify the point of discharge and take measures to eliminate further discharges. Absorb discharged material with sand, clean fill, or other noncombustible absorbent materials. Place the absorbent/discharge mixture into 55-gallon poly-drums.

3.1.3. Decontamination Procedures. Decontamination procedures shall be required after cleaning to eliminate traces of the substance spilled or reduce it to an acceptable level as determined by the Contracting Officer. Complete cleanup may require removal of contaminated soils. Personnel decontamination shall include showers. Clothing and equipment shall be decontaminated or disposed of as applicable. All contaminated materials including solvents, cloth, soil, and wood that cannot be decontaminated shall be properly containerized, labeled, and properly disposed of in 55-gallon polydrums.

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SECTION 01510

TEMPORARY SITE UTILITIES AND SERVICES

INDEX

1. GENERAL
2. EXECUTION

1. GENERAL.

1.1. SITE REQUIREMENTS

1.1.1. As presented below and for the purpose of performing the work, utilities are defined as telephone, water and electrical power services. The costs for connecting, supplying, and metering these services to the site shall be paid by the Contractor.

1.2. REGULATORY REQUIREMENTS. Obtain all necessary approvals for the use of the provided utilities.

1.3. SUBMITTALS.

1.3.1. In accordance with Section 01100 SPECIAL CLAUSES, paragraph 4 - Submittals and Section 01305 SUBMITTAL PROCEDURES, the Contractor shall submit information as specified herein on the following:

1.3.1.1. Category I.

1.3.1.1.1. Submit shop drawings showing location and details of all water connections including gate valves, tap tees, and valve boxes.

1.3.1.1.2. Submit shop drawings showing location and details of all Electrical and Telephone connections.

1.3.1.2. Category II (for information only). None.

1.3.1.3. Category II (for approval). None.

1.3.2. For further description of submittals: See Section 01300 DESCRIPTIONS.

2. EXECUTION.

2.1. GENERAL.

2.1.1. The Contractor shall be responsible for providing all telephone, electrical and water service to the site, necessary to do the work.

2.1.2. The Contractor shall be responsible for the operation of all systems, including maintenance, to assure that necessary services are provided.

2.1.3. The Contractor shall be responsible for all telephone costs including installation, service charges (except the Contracting Officer toll charges) and discontinuance.

2.1.4. The Contractor shall be responsible for all electrical and water charges. The Contractor shall make no connection to the sanitary sewer system.

2.2. WATER SUPPLY.

2.2.1. The Contractor shall provide the necessary water supply of sufficient volume and pressure to meet the requirements of the work. Two water connection points have been indicated on the Drawings. One connection point is at the tank via the SQI piping system. The second connection point is on the north side of 9th Avenue. Coordinate the connection to the water supply with the Contracting Officer. The Contractor shall provide the necessary tapping equipment, fittings and valves for connection to the system. The Contractor shall state his proposed pressure and volume requirements in the proposal.

2.2.2. The water systems shall be maintained and protected from weather until completion of the work and removed and disposed of as approved by the Contracting Officer.

2.3. SANITARY WASTE SYSTEM. The Contractor shall furnish all required toilet facilities. Unless otherwise specified, the outdoor toilet facilities shall be the chemical type, insofar as possible, in order to minimize water usage requirements. No toilet facilities shall be provided in the Exclusion Zone. The

Contractor shall not discharge any water, wastewater, or other wastes into the sanitary sewer system.

2.4. **TELEPHONE SERVICE.** The Contractor shall make the necessary arrangements with the local Telephone Company to install equipment and services to meet site requirements and shall be responsible for all related installation, service and shut-off costs. Due to the limited duration of this project, cellular phone service in an option.

2.5. **ELECTRICAL POWER.**

2.5.1. An electrical service termination-connection point has been indicated on the drawings. The Contractor shall be responsible for providing such service to the Support, Contamination Reduction, and Exclusion Zones, as necessary to conduct the work.

2.5.2. The Contractor shall provide adequate lighting in the work zones at the site and shall be responsible for the installation and maintenance of the same. The power service lines and the lighting poles and fixtures shall remain on-site after the project closeout.

2.5.3. The Contractor shall provide all necessary electrical power of sufficient quantity to meet the requirements of the work.

2.6. **METERING OF UTILITIES.** Utilities shall be metered (Contractor supplied) at the point of connection.

ZERO ACCIDENTS

SECTION 02073

REMOVAL AND DISPOSITION OF MATERIALS AND APPURTENANCES FROM EXISTING TANKS

INDEX

- 1. GENERAL**
- 2. PRODUCTS**
- 3. EXECUTION**

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Process Description and Contractor Responsibility. The Contractor shall provide and operate such equipment and materials to perform the removal of the sludges remaining in Tank 102 after the completion of the dissolution process (Phase 1); to decontaminate and remove the 100 mil HDPE liner and 200 mil HDPE geonet inside the tank; to remove any corrosion from the tank wall; to decontaminate the tank wall and the Alumadome roof; to decontaminate all valves, flanges, and other contaminated appurtenances; and to safely handle all wastes and wastewaters generated during this task.

The Contractor shall provide all labor, materials, equipment, and associated services necessary to procure, fabricate, deliver to the job site, install, test, and operate the equipment and systems necessary to perform the work as shown on the Drawings and specified herein.

1.1.2 Classifications of Removed Materials.

1.1.2.1 REINSTALLED. Items are those items which, after removal and decontamination, are to be reused, reinserted, remounted or otherwise built back into the work under this contract.

1.1.2.2 STORED ON SITE. Items are those items which, after removal, are to be retained by the Government and delivered for storage on Government premises.

1.1.2.3 OFF-SITE DISPOSAL. Items are all other removed materials. This includes all items which are not noted or specified for reinstallation or on site storage.

1.1.2.4 ON-SITE TREATMENT AND DISPOSAL. Items are liquids generated during dewatering of the sludge and decontamination of the materials that is collected.

1.1.3 DISPOSITION BY CLASSIFICATION.

1.1.3.1 REINSTALLED. Items of material as specified to be reinstalled in the work shall be jointly inspected by the Contractor and the Contracting Officer prior to dismantling or removal. An agreement shall be signed briefly setting forth the apparent condition of the material or equipment. Simple operating tests of operative equipment will be included with this joint inspection if feasible. Such items shall include all inlet and outlet valves, the manholes, any roof panels that are removed, all blind flanges, and any piping that has been removed.

1.1.3.2 STORED ON SITE. Materials and equipment listed to be stored on site shall be delivered to the Building 785, located on the southeast corner of 7th Avenue and "E" Street at RMA. A different delivery site may be specified by the waste management contractor for the Army for any large wastes, such as piping, equipment, etc. Items to be stored on site include the sludges after being dewatered and drummed, any contaminated soils, and any equipment that cannot be decontaminated.

1.1.3.3 OFF-SITE DISPOSAL. All removed materials and equipment not noted on the drawings or specified to be reinstalled, nor listed to be stored on site, shall be considered as scrap and shall be disposed of by the Contractor off the Government premises at a RCRA subtitle C permitted landfill. Such items include all HDPE liners and geonets.

1.1.3.4 ON-SITE TREATMENT AND DISPOSAL. All water generated from scrubber blowdown, dewatering the sludges, and decontamination

of materials and personnel shall be collected and transported by tank truck to the CERCLA Wastewater Treatment Facility for treatment and ultimate disposal. The CERCLA Wastewater Treatment Facility is located on the northwest corner of 7th Avenue and "C" Street and contains an equipment decontamination bay.

1.2 STANDARD PRODUCTS. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the job-site. Equipment of the same types shall each be the product of one manufacturer.

1.3 VERIFICATION OF DIMENSIONS. The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.4 SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 1300 Submittal Descriptions not later than 6 weeks prior to start of construction

1.4.1 Settling Tanks - GA1. Manufacturer's catalog cuts or data sheets indicating materials of construction, tank dimensions, and capacities. Drawings showing the type, size, elevation, and orientation of all connections and manways.

1.4.2 3" Diaphragm Pump (Air Driven) - GA1. Manufacturer's catalog cuts or data sheets with detailed specifications covering materials of construction, performance, and power drive assembly. Pumping curves indicating total dynamic head, flow rate, air pressure, and air consumption.

1.4.3 Automatic Tank Washer - GA1. Manufacturer's catalog cuts or data sheets with detailed specifications covering materials of construction, pressure-flow rate versus impingement pressure, length of cycle versus flowrate, and impingement pattern.

2 PRODUCTS

2.0.1 SETTLING TANKS ST-101 and ST-102. The tanks shall have a minimum capacity of 7000 gallons. The material of construction shall be cross-linked polyethylene. The design shall include an enclosed top with a 60° cone bottom, and support stands. Accesses shall include 2' diameter manhole on top, 3" and 4" fittings at the top and a 4" fitting at the bottom, all fittings shall be stainless steel, and baskets and stands.

2.0.2 3" DIAPHRAGM PUMP (Air Driven). The diaphragm pump shall meet the minimum delivery requirements of the Automatic Tank Washer for full impingement pressure and flow.

2.0.3 AUTOMATIC TANK WASHER. The automatic tank washer shall be capable of impingement pressures of 5 psi at 40 feet distance and completely cover the inside of the tank and roof with its tightest pattern.

3 EXECUTION

3.1 PREPARATION

3.1.1 Grading. Using skid steers or similar low ground pressure equipment, grade the area between the northeast quadrant of the tank and the north and east berms as shown in the Drawings. At the west and south limits of grading 1 foot high berms shall be graded to run between the tank and the existing secondary containment berms. At no location should the existing surface be lowered by more than 6", due to the existing 100 mil HDPE secondary containment liner.

3.1.2 100 mil HDPE Containment Pad. In the graded area, place 100 mil HDPE liner. The liner will be laid up the side of the tank and the existing berms, 1 foot vertically. The liner will be laid across the 1 foot high berms. The liner will be anchored at all edges using spikes, dirt fill, or other available means. All seams will be extrusion welded to manufacturers specifications. At the locations specified in the Drawings, 200 mil geonet will be glued to the 100 mil liner to provide walkways.

3.1.3 Tank Access. An access hole will be cut in the tank at the northeast quadrant in the same location that was used during liner construction. Build an access ramp up to the bottom of the access hole using

flexible base material. The slopes shall be no steeper than 5:1 (horizontal to vertical). Weld three hinges and two hasps to the tank along the locations of the proposed vertical cuts. Cut the hatch out. While cutting, spray water into the cut behind the cutting torch to keep the HDPE liner and geonet from igniting.

3.1.4 Install Wastewater Removal System. Build a flexible base pad, 15 feet by 30 feet by 1 foot thick, as shown on the Drawings. ST-101 and ST-102 will be erected on the pad. The wastewater removal system piping will consist of 3 inch diameter PVC pipe from the tanks to the pump, a 3 inch diaphragm pump, 2 inch diameter rubber suction hose from the pump to Tank 102 for dewatering the sludge in situ, and a $\frac{1}{2}$ inch suction line for dewatering drums and the containment area sump.

3.1.5 Install Lighting System. The power cables will be run through the access hatch on the roof and suspended from the roof supports. The lighting will also be suspended from the roof supports. The system will be watertight.

3.1.6 Sludge Handling System. The sludge handling system will consist of a hopper (6 feet long by 1.5 feet deep by 3 feet wide) fabricated from steel plate. The liner and geonet will be removed from the location of the hopper and the hopper will be welded to the side of the tank. The bottom of the hopper will be sloped to a one foot diameter hole in the center. A chute will be fabricated from 1 foot diameter steel pipe to transfer the sludge from the hopper to the drum loading area on the outside of the tank as shown on the Drawings. A concrete form vibrator will be attached to the hopper to facilitate movement of the sludge through the chute.

3.1.7 Remove Sludge. Prior to removal, the sludge will be dewatered using the 2 inch diameter suction line. Sump holes will be excavated in the sludge and the liquid removed using the suction line. The sludge will be removed using two skid steer loaders. The sludge will be loaded into drums via the hopper and chute. After the drum is filled, workers will insert a concrete "stinger" vibrator into the sludge to settle the solids. Any free liquid at the surface will suctioned off using the $\frac{1}{2}$ inch suction line. Then, the drum will be sealed. The drums will be moved from the drum loading area to the drum storage area using an Integrated Tool Carrier (Caterpillar IT2) with a drum grapple. Drums will be transferred from the drum storage area to flatbed trucks for transport to the Building 785 using a hydraulic crane.

3.1.8 Decontaminate Skid Steers. A pressure washer will be used to decontaminate the skid steer loaders inside the tank. Care will be taken to remove any contamination from the underside and other hard to reach places. The equipment will then be loaded on a flatbed truck or trailer with a plastic sheet in the bed. The equipment will be transported to the CERCLA Wastewater Treatment Facility for final decontamination. The equipment will have the tires, skid plate, and other pieces removed to allow a thorough cleaning of the equipment.

3.1.9 Install Tank Decontamination Hot Water Supply. Settling tank ST-101 will be used as a surge tank. Transfer 5600 gallons of clean water to ST-101 using the water supply from SQI or tank trucks. The water will be circulated through heat exchanger HE-101 using pump P-101, 4 inch diameter rubber hose for suction and discharge lines, and existing valves in the heating and recirculation system. The water will be heated and recirculated until it reaches 60° C.

3.1.10 Install Automatic Tank Washer. The wastewater removal piping will be valved to include a suction line from the bottom outlet of ST-101 to P-114 and then 3" flexible hose to the tank washer. The 3" hose will be run up the stairway, through the access hatch on the roof, and to the tank washer location. A manlift will be used to suspend the hose and tank washer from the roof supports. The tank washer will be suspended from the roof in locations and heights shown on the Drawings. A sheet of HDPE will be extrusion welded across the access hatch and the hatch closed for the cleaning operation.

3.1.11 Primary Decontamination of Tank Liner and Alumadome Roof.

Using the manlift, the liner will be slit in 3 foot long horizontal cuts every 10 feet on center and the slits pulled away from the tank to allow water from the tank washer to wash the liner and geonet. The liner shall be cut around the perimeter along the bottom to allow any liquid trapped behind the liner in the geonet to drain out. The tank will be washed using 5600 gallons at each location. At the conclusion of the cleaning, the water will be removed from the tank by squeegeeing to low spots and using the suction line. The water will be transferred to the settling tanks and allowed to settle for six hours, after that time the supernate will be pumped to a tank truck for transfer to the CERCLA Wastewater Treatment Facility and any sediments that have settled out will be drummed.

3.1.12 Removal and Final Decontamination of the Liner.

The liner will be cut down and into 3'6" square pieces. After the pieces are removed, they will be layed on the floor and washed using a pressure washer (4000-5000 psi, 60-80° C, and 3-5 gpm). Each side should be washed for 1 to 2 minutes or until all visible contamination is removed. The liner will then be squeegeed until near dry, removed from the tank, placed on pallets and bundled using nylon straps.

Wastewater will be handled in the same manner as during other activities.

3.1.13 Removal and Final Decontamination of the Geonet.

These work activities will be the same as for the liner in Section 3.1.11 and Section 3.1.12.

3.1.14 Decontaminate Tank Wall and Bottom.

The tank walls will be cleaned using a pressure washer (8000-10000 psi, 60-80° C, and 3-4 gpm). A manlift will be used to access the top of the wall. Cleaning will begin starting at top and working around the tank and then down. Care shall be taken not to contaminate any surface which has already been cleaned, including the roof. Workers using spray wands will position the bucket on the manlift and the wand in such a manner as to minimize sprayback on themselves.

3.1.15 Decontaminate Appurtenances.

All valves that are not connected to SQI piping, all blind flanges, and any other fittings or appurtenances will be removed, decontaminated using the pressure washer and replaced.

3.1.16 Decontaminate Equipment.

All equipment that has been in contact with wastewater, sediments, or other contaminated items will be grossly decontaminated in the tank using the pressure washer. Items to be decontaminated include: the tank washer and hoses; manlifts; pressure washer hoses and wands; any small tools used during liner removal; and the lighting and power cords. On the equipment, all removable plates and covers will be removed to allow any contamination to be cleaned. The equipment will then be transported to the CERCLA Wastewater Treatment Facility using flatbeds or trailers that have plastic lined beds for final decontamination.

3.1.17 Demobilize.

Demobilization will include removing and transporting to storage any equipment owned by the Army; removing and drumming the flex base used for pads; removing, decontaminating and drumming the 100 mil liner used for the containment area; regrading the containment area to existing; and seeding the area with natural grass.

ZERO ACCIDENTS

SECTION 11200

EMISSION CONTROL SYSTEM

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL

1.1. REFERENCES. The publications listed below form a part of this specification to the extent referenced.

1.1.1. Draft Final Alternatives Evaluation for Basin F Ponds and Tanks Decontamination, March 1992. (Alternatives Evaluation)

1.1.2. Emission Isolation Flux Chamber Measurements at Rocky Mountain Arsenal Final Report, February 10, 1989. (Flux Chamber Report)

1.2. GENERAL REQUIREMENTS

1.2.1. Process Description and Contractor's Responsibility. The Contractor shall install and operate an emission control system during the Tank 102 Decontamination Demonstration so as to prevent the release to the ambient air vapors of ammonia, toxic organic compounds, and odors. The system shall be designed, installed, and operated so that no odors are produced on-site or off-site. The emission control system shall be used to maintain negative pressure in the head space of Tank 102 during operation of the tank content heating and crystal dissolution phase of the project. The emission control system shall be used to purge the Tank 102 volume during the tank interior decontamination phase of the project.

The emission control system shall consist of ammonia gas scrubber systems, air blowers, granular activated carbon (GAC) air filters, chemical storage tanks, and associated gas ducting, piping, valves, instruments, electrical wiring and controls as indicated on the Drawings. Specific requirements for individual elements of the emission control system are included in the applicable sections of these specifications.

Work excluded: freeze protection.

The Contractor shall provide all labor, materials, equipment, and associated services necessary to procure, fabricate, deliver to the job site, install, test, and operate the emission control system as shown on the Drawings and specified herein. The operating criteria for operation of the emission control system during the two phases of the project is as follows:

1.2.2. Phase One - Tank 102 Content Heating and Crystal Dissolution. The emission control system shall be operated continuously during the implementation of the Tank 102 content heating and crystal dissolution. The successful operation of the emission control system shall have been demonstrated to the Contracting Officer's (CO's) satisfaction prior to beginning the Phase One operation. The emission control system shall be operated to maintain a negative pressure in the head space of Tank 102 and to remove ammonia vapors, toxic organic compounds, and odors from the vented gas prior to discharge to the atmosphere. This operation shall begin prior to initiation of operation of the tank liquid heating and recirculation system and shall continue until the initiation of operation of the Phase Two tank decontamination. Operating conditions for Phase One are:

System Location: Rocky Mountain Arsenal, Commerce City, Colorado. System will be installed and operated outdoors.

Tank 102 Configuration: Closed top sealed except for manually adjusted air inlet through vent valve on tank roof as indicated on Drawings.

Tank 102 Head Pressure: 0.05 to 0.2 inches water vacuum

Vent Gas Flow Rate: 500 to 1300 cfm at gas temperatures of 40 to 140 F and 0 to 100% humidity. Vent gas flow from inflow through joints in tank cover and through manual inlet valve on tank cover.

Ammonia Concentrations in Vent Gas: 0 to 2 mg/liter.

Organic Vapor Concentrations: Not quantified. Total volatile organic compound concentrations anticipated to be less than 0.001 mg/l. Consult Alternatives Evaluation and Flux Chamber Report for additional information on potential organic compound and odor emissions.

1.2.3. **Phase Two - Tank 102 Interior Decontamination.** The emission control system shall be operated continuously during the implementation of the Tank 102 interior decontamination. The successful operation of the emission control system shall have been demonstrated to the CO's satisfaction prior to beginning the Phase Two operation. The emission control system shall be operated to maintain an air inflow through the access port installed in the tank wall for the Phase Two operations and to remove ammonia vapors, toxic organic compounds, and odors from the vented gas prior to discharge to the atmosphere. This operation shall begin prior to entry of personnel into the tank and shall continue until the decontamination of the tank interior is complete and all liners, geonet, and other debris have been removed. Operating conditions for Phase Two are:

System Location: Rocky Mountain Arsenal, Commerce City, Colorado. System will be installed and operated outdoors.

Tank 102 Configuration: Air inflow through access port installed in Tank 102 wall as indicated on Drawings. Minimum air velocity into tank through port of 200 fpm to be maintained.

Vent Gas Flow Rate: 13,000 cfm at gas temperatures of 40 to 100 F and 0 to 100% humidity.

Ammonia Concentrations in Vent Gas: 0 to 0.2 mg/liter.

Organic Vapor Concentrations: Not quantified. Total volatile organic compound concentrations anticipated to be less than 0.0001 mg/l. Consult Alternatives Evaluation and Flux Chamber Report for additional information on potential organic compound and odor emissions.

1.3. **STANDARD PRODUCTS.** Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. Equipment shall be supported by a service organization that is, in the opinion of the CO, reasonably convenient to the jobsite. Equipment of the same types shall each be the product of one manufacturer.

1.4. **ITEMS SPECIFIED IN OTHER SECTIONS OF THESE SPECIFICATIONS.** Items which are specified in other sections of these specifications which form a part of the emission control system include:

- 1.4.1. Section 11205 - Ammonia Scrubber Systems
- 1.4.2. Section 11210 - Chemical Storage Tanks
- 1.4.3. Section 11215 - Granular Activated Carbon Filters
- 1.4.4. Section 15510 - Process Piping
- 1.4.5. Section 15890 - Ductwork
- 1.4.6. Section 15910 - Ductwork Accessories
- 1.4.7. Section 15980 - Instrumentation
- 1.4.8. Section 15985 - Sequence of Operation
- 1.4.9. Section 16111 - Conduit
- 1.4.10. Section 16123 - Wire and Cable
- 1.4.11. Section 16170 - Grounding and Bonding
- 1.4.12. Section 16480 - Motor Control

1.5. **VERIFICATION OF DIMENSIONS.** The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the CO of any discrepancy before performing the work. Materials and equipment shall fit into the space allotted and with adequate and acceptable clearances allowed for entry, maintenance, and operation.

1.6. **SUBMITTALS.** Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 - Submittal Descriptions:

1.6.1. **Emission Control System - GA1.** Detail drawings containing complete wiring and schematic diagrams and any other details to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment

relationship to other parts of the work including clearances for maintenance and operation. Drawings and diagrams shall be submitted not later than one month prior to start of construction.

1.6.2. **Tests - GA2.** Test reports in booklet form showing all field test performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls. The test reports shall be submitted one day following completion of field tests.

1.6.3. **Operation and Maintenance Manual - FIO.** Six complete copies of operating and maintenance manual outlining the step-by-step procedures for system start-up, operation, shutdown, and maintenance. The manuals shall include the manufacturer's name, model number, number, service manual, parts list, and brief description of all equipment and their basic operating features. The manuals shall include a listing of routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The manuals shall include piping layout, equipment layout and simplified wiring and control diagrams of the system as installed. The manuals shall specify the procedures for collection and disposal of ammonia scrubber system blowdown water. The manuals shall specify the procedures for return of spent GAC filters to the manufacturer for thermal regeneration and disposal of the GAC including requirements for testing and transport manifests. The manuals shall be submitted within one week following completion of field testing system.

1.7. **DELIVERY AND STORAGE.** All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

2. PRODUCTS.

2.1. **EMISSION CONTROL SYSTEM.** The emission control system shall consist of ammonia gas scrubber systems, air blowers, granular activated carbon (GAC) air filters, chemical storage tanks, and associated gas ducting, piping, valves, instruments, electrical wiring and controls as indicated on the Drawings and specified in this and other applicable sections.

2.1.1. **Nameplates.** Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a non-corrosive plate secured to the item of equipment in a conspicuous place. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the nameplate.

2.1.2. **Electrical Work.** Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment and wiring shall be in accordance with Section 16000 - Electrical Specifications. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices but not shown, shall be provided under this section of the specifications. Motor frames shall be of the totally enclosed type. Temperature rise shall be based on 40 degrees F. ambient temperature.

2.1.2.1. Electric motors shall conform to NEMA 1.

2.1.2.2. Motor controls shall conform to NEMA ICSI. Enclosures shall be NEMA 2 Rated.

2.1.3. **Bolts, Nuts, Anchors, and Washers.** Bolts, nuts, anchors, and washers shall be steel; galvanized in accordance with ASTM A153.

2.1.4. **Pressure Gauges.** Compound gauges shall be provided on the suction side of pumps and standard pressure gauges on the pump(s) discharge side. Gauges shall comply with ASME B40.1. Gauge ranges shall be as appropriate for the particular installation.

2.1.5. **Seal Water.** Pumping equipment requiring seal water shall utilize fire water.

3. EXECUTION.

3.1. INSTALLATION. The emission control system shall be installed so as to provide a complete and integrated system in accordance with the Drawings and these specifications. The equipment is to be placed within the secondary containment area for the Basin F Liquid Storage Tanks. A plastic liner is located 12-inches below the soil surface in this containment area. The Contractor shall provide appropriate supports to distribute the equipment loads and exercise due care in equipment installation to prevent damage to the liner integrity.

3.2. START-UP TESTING. The Contractor shall conduct operating tests to assure that the emission control system operates properly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be repeated. The system must perform to the satisfaction of the CO prior to initiation of Phase One of the project.

3.3. OPERATION. The Contractor shall operate the emission control systems on a continuous basis during implementation of Phases One and Two of this project. The system performance and vent gas emissions shall be monitored in the manner specified in Section 1402 Chemical Data Management of these specifications.

3.3.1. Scrubber Blowdown Water. Blowdown water from operation of ammonia scrubber systems shall be collected and transported to Pond A or to the RMA CERCLA water treatment facility for treatment as directed by the CO. The Contractor shall be responsible for transport of the water in a manner and on a schedule acceptable to the facility operations management. A maximum blowdown rate of 1 gpm is estimated during operation of the ammonia scrubber systems during both project phases.

3.3.2. Spent GAC. The Contractor shall be responsible for return of spent GAC filters to the manufacturer when replacement is required and at the conclusion of the project. The transport and disposal of the GAC shall be conducted in compliance with applicable regulations. It is anticipated that no replacement of GAC filters will be required. The Contractor shall not include cost for GAC filter replacement in the base bid, but shall include a unit price for GAC filter replacement should this be required.

3.4. DEMOBILIZATION. The Contractor shall disassemble the emission control system at the end of the project. Equipment purchased by the Owner for the project shall be decontaminated and delivered to a storage site on the Rocky Mountain Arsenal or disposed of as directed by the CO.

ZERO ACCIDENTS

SECTION 11205

AMMONIA SCRUBBER SYSTEMS

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL

1.1. GENERAL REQUIREMENTS.

1.1.1. **Standard Products.** Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.2. **DESCRIPTION.** The ammonia scrubber systems shall be designed to remove the ammonia vapors from the gas withdrawn from the Tank 102 head space during operation of the emission control system as shown on the Drawings. The scrubber systems shall use circulation of a weak acid solution through a countercurrent packed tower to adsorb the ammonia from the vent gas. The pH of the adsorption solution shall be automatically controlled and maintained in the proper range through automatic addition of acid based on measurement of the pH. The increase of dissolved solid content in the scrubber adsorption solution shall be prevented through the continuous removal of a blowdown bleed. Make-up water shall be added automatically to the scrubber system as required. Two scrubber systems shall be required one for treatment of vent gas generated during the Phase One of the project and the second to treat the vent gas generated during the Phase Two of the project. Each separate system shall be skid mounted and shall be a complete and integrated system consisting of scrubber tower, scrubber liquid circulation pump and motor, air blower and motor, pH indicator/controller and chemical feed pump, motor starters, controls, wiring, gas ducting, piping, valves, instruments, and any other required equipment or appurtenances.

1.3. **OPERATING REQUIREMENTS.** The ammonia scrubber systems shall be designed, fabricated, installed, and operated to conform with the following operating criteria specified below. The scrubber systems shall be designed and installed in a manner which prevents the release to the atmosphere of ammonia vapors, toxic organic compounds, and odors. The systems shall be rated for continuous operation and shall require a minimum of operator attention during operation. The systems will be installed and operated outdoors at the project location Rocky Mountain Arsenal, Commerce City, Colorado.

1.3.1. **Phase One Operation.** The minimum operating requirements during Phase One - Tank Content Heating and Crystal Dissolution will be:

Scrubber Inlet Vent Gas Flow = 500 to 1300 cfm at gas temperatures of 40 to 140 F and 0 to 100% humidity.

Ammonia Concentration Inlet Gas = 0 to 2 mg/liter.

Minimum Removal Ammonia Efficiency for Scrubber = 99%

Maximum Operating Gas Pressure Differential Through Scrubber System = 2 inches water

Minimum Vacuum Pressure Rating for Scrubber System = 12 inches water vacuum

1.3.2. **Phase Two Operation.** The minimum operating requirements during Phase Two - Tank Interior Decontamination will be:

Scrubber Inlet Vent Gas Flow = 13,000 cfm at gas temperatures of 40 to 100 F and 0 to 100% humidity.

Ammonia Concentration Inlet Gas = 0 to 0.2 mg/liter.

Minimum Removal Ammonia Efficiency for Scrubber = 99%

Maximum Operating Gas Pressure Differential Through Scrubber System = 2 inches water

Minimum Vacuum Pressure Rating for Scrubber System = 12 inches water vacuum

1.4. **SAFETY REQUIREMENTS.** Gears, couplings, projecting set-screws, keys, and other rotating parts, so located that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

1.5. **ELECTRICAL WORK.** Electrical motor driven equipment specified herein shall be provided complete with motors, motor starters, and controls. Electrical equipment and wiring shall be in accordance with the electrical sections of these specifications. Control systems shall be in accordance with the instrumentation section of these specifications. Motor starters shall be provided complete with properly sized thermal overload protection in each phase and other appurtenances for motor control specified. Each motor shall be of sufficient capacity to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage and frequency.

1.6. **VERIFICATION OF DIMENSIONS.** The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work. Materials and equipment shall fit into the space allotted and with adequate and acceptable clearances allowed for entry, maintenance, and operation.

1.7. **SUBMITTALS.** Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 1300 Submittal Descriptions not later than 6 weeks prior to start of construction:

1.7.1. **Scrubber Systems - GA1.** A complete list of equipment and material, manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions. Spare parts data for each different item of material and equipment specified including a complete list of parts and supplies with a source of supply.

1.7.2. **Packed Towers - GA1.** Manufacturer's catalog cuts or data sheets indicating materials of construction, performance criteria, operating limits, dry and operating weights, certified curves for pressure drop through tower at ranges of air and water loadings typical of anticipated operation. Drawings showing the type, size, elevation, and orientation of all connections, details of tower internals including packing support, fluid distribution system, demister.

1.7.3. **Scrubber Pumps - GA1.** Manufacturer's catalog cuts or data sheets with detailed specifications covering materials of construction, performance, power drive assembly. Installation data, including complete fabrication, assembly, and installation drawings. Pumping curves indicating total dynamic head, flow rate, brake horsepower, net positive suction head required, and efficiency. Motor data, including the manufacturer, the horsepower, the minimum guaranteed efficiency and power factor, locked motor current in amps, the motor speed in rpm, and mounting details.

1.7.4. **Air Blowers - GA1.** Manufacturer's catalog cuts or data sheets with detailed specifications covering materials of construction, performance, power drive assembly. Installation data, including complete fabrication, assembly, and installation drawings. Blower curves indicating static pressure, flow rate, blower speed, brake horsepower, and efficiency. Motor data, including the manufacturer, the horsepower, the minimum guaranteed efficiency and power factor, locked motor current in amps, the motor speed in rpm, and mounting details.

1.7.5. **Chemical Feed Pumps - GA1.** Manufacturer's catalog cuts or data sheets with detailed specifications covering materials of construction, performance, power drive assembly. Installation data, including complete fabrication, assembly, and installation drawings, and instructions and diagrams for control wiring for control of delivery rate based on external pH indicator controller. Performance data, including range of delivery flow rates and pressures.

1.7.6. **pH Indicators/Controller - GA1.** Manufacturer's catalog cuts or data sheets with detailed specifications covering materials of construction and performance. Installation data, including complete fabrication, assembly, and installation drawings, and instructions and diagrams for control wiring

including connections to pH probe and chemical feed pumps. Operation instructions, including theory of operation, system wiring, calibration, adjustments.

2. PRODUCTS

2.1. **PACKED TOWERS.** Towers shall be countercurrent packed tower design to remove ammonia from air. Ammonia removal shall be through circulation of water maintained at pH 2 to 4. The water pH shall be maintained through addition of 50 weight percent sulfuric acid. A continuous water blowdown shall be used to control increase of ammonium sulfate salt in water. Water make-up shall be added as required.

2.1.1. **Tower Construction.** Towers shall be constructed of high density polyethylene or fiberglass reinforced plastic (FRP). All internal parts shall be polyethylene, FRP, or type 316 stainless steel.

2.1.2. **Packing Material.** Packing material shall be a high efficiency polyethylene or polypropylene dumped packing material Jaeger Tri-Packs Tellerettes or equal. Packing size shall be nominal 2 inch diameter.

2.1.3. **Packing Support and Water Distribution.** Packing support and water distribution systems shall be designed to provide for uniform distribution of scrubber water and air flow through total depth of packing. The pressure loss through the towers shall not exceed 2 inches water over the range of anticipated air and water flow rates. The pressure loss through the water distribution systems shall not exceed 5 psig at the design water flow rate.

2.1.4. **Air Demister.** Towers shall be supplied with a mist-removal system above the water distribution system. The demister shall be plastic or stainless steel mesh and shall eliminate at least 95 percent of water droplets greater than 40 microns in diameter.

2.1.5. **Wet Wells.** The wet wells in the bottom of the towers shall be furnished with suitable internal baffles to ensure that the water in the region of the circulation pump intake is quiescent and air free. Minimum wet well volume shall be provided to allow 1-1/2 minutes liquid residence time at operating liquid recirculation rate. Make-up water shall be automatically added to the wet well as required to maintain the water level within the operating high and low limits as indicated on the Drawings.

The wet wells will be equipped with three level switches (LSHH, LSH, LSL). The high and high switches will be used to maintain level in the proper operating range. The LSL will be used for pump protection should the well level fall below the pump suction. Wetted materials of the switches shall be compatible with the 2-4 pH of the sump liquid. Each switch shall have 2 NO and 2 NC contacts rated for 5A at 115VAC.

2.1.6. **Tower D-101.** The design conditions for this tower are as follows:

- Diameter = 72 inches
- Packing Depth = 72 inches
- Water Circulation Rate = 170 gpm
- Air Flow Rate = 10000 to 13000 cfm
- Air Inlet Ammonia Concentrations = 0 to 0.2 mg/l
- Ammonia Removal Efficiency = 99 percent
- Minimum Wet Well Volume - 255 gallons
- Estimated Blowdown Flow - 1 gpm
- Estimated Makeup Water Flow - 1.2 gpm

2.1.7. **Tower D-102.** The design conditions for this tower are as follows:

- Diameter = 24 inches
- Packing Depth = 72 inches
- Water Circulation Rate = 20 gpm
- Air Flow Rate = 700 to 1300 cfm
- Air Inlet Ammonia Concentrations = 0 to 2 mg/l
- Ammonia Removal Efficiency = 99 percent
- Minimum Wet Well Volume - 30 gallons
- Estimated Blowdown Flow - 1 gpm
- Estimated Makeup Water Flow - 1 gpm

2.2. SCRUBBER PUMPS. Pumps shall be ANSI horizontal end-suction frame mounted centrifugal water pumps. Pump construction shall be type 316 stainless steel. Pump seals shall be water lubricated, single balanced metallic bellows type mechanical seal, API Plan II. Electric motors shall be TEFC. Pump and motor shall be mounted on cast iron baseplate. **2.2.1. Scrubber**

Pump P-103. The design conditions for this pump are:

Fluid = Water pH 2 to 4 with ammonium sulfate 0 to 10 %

Flow Rate = 170 gpm

TDH = 60 feet

Net Positive Suction Head = 30 feet

Motor - 5HP, 460V, 3 Phase, 60 Hz

2.2.2. Scrubber Pumps P-104 and P-105. The design conditions for these pumps are:

Fluid = Water pH 2 to 4 with ammonium sulfate 0 to 10 %

Flow Rate = 20 gpm

TDH = 60 feet

Net Positive Suction Head = 30 feet

Motor - 3HP, 460V, 3 Phase, 60 Hz

2.3. AIR BLOWERS. Blowers shall be centrifugal industrial fans rated for continuous outdoor duty. Blowers shall be driven by electric motors with v-belt drive. Blowers shall comply with all applicable regulations including OSHA. Fan construction shall be steel. All interior surfaces and fan wheel in contact with the air stream shall be coated with an epoxy coating for chemical resistance. All other surfaces shall have standard factory-baked enamel finish. Electric motors shall be TEFC. Fans and motors shall be mounted on a steel baseplate. Steel guard shall be provided for V-belt drive and motor and fan shafts. Blower performance shall be based on the total system pressure loss under full load operating conditions, including all losses in ducting, ammonia scrubber towers, and granular activated carbon filters.

2.3.1. Air Blower BL-101. The design conditions for this blower are:

Air Flow Rate = 13000 cfm at 1 atm and 25 C

Static Pressure = 12 inches water

Motor = 40 hp, 460 V, 3-phase, 60 Hz

2.3.2. Air Blower BL-102. The design conditions for this blower are:

Air Flow Rate = 1100 cfm at 1 atm and 25 C

Static Pressure = 12 inches water

Motor = 7.5 hp, 460 V, 3-phase, 60 Hz

2.4. CHEMICAL FEED PUMPS. Chemical metering pumps shall be positive displacement type with electric drive. Materials of construction shall be suitable for service in pumping sulfuric acid at concentrations of 50 percent. Pump stroke length shall be manually adjustable during pump operation to manually vary pump output from zero to maximum capacity. Pump stroke frequency shall be automatically adjusted to vary pump output from zero to maximum capacity based on a 4 to 20 mA DC current external input from pH indicator/controller. Pump suction line shall be provided with a foot valve. Pump discharge shall be provided with a check/back pressure valve. Pump design shall incorporate an anti-syphon protection to allow controlled metering of acid into the suction side of the circulation pumps as indicated on the Drawings. Pump design shall incorporate an inherent pressure relief mechanism to prevent pump discharge pressure rating from being exceeded under any conditions. Pump drive and electronics shall be totally enclosed in a NEMA 4 enclosure. Pump drive shall be 120 V, 60 Hz, single phase.

2.4.1. Chemical Feed Pump P-106. The design conditions for this pump are:

Fluid = 50% Sulfuric Acid

Pump Output = 0 to 4 gph

Pump Maximum Discharge Pressure = 25 psig

Pump Stroke Length Control = Manual

Pump Stroke Frequency Control = Automatic

2.4.2. Chemical Feed Pump P-107. The design conditions for this pump are:

Fluid = 50% Sulfuric Acid
Pump Output = 0 to 4 gph
Pump Maximum Discharge Pressure = 25 psig
Pump Stroke Length Control = Manual
Pump Stroke Frequency Control = Automatic

2.5. pH INDICATOR/CONTROLLERS. Units shall include pH probes, process controllers with output indicators, and connecting wiring. pH sensors shall measure hydrogen activity in the process medium. Sensor accuracy shall be ± 0.01 pH units over measuring range of 0 to 14 pH. Sensors shall be encapsulated submersion design for mounting in the wet wells of scrubber towers as indicated on the Drawings. Sensors shall operate of temperature range of 0 to 100 C with automatic temperature compensation. Sensors shall incorporate an integral two wire transmitter.

Proportional controllers shall provide a analog 4 to 20 mA DC proportional output signal based on the input signal from the pH probe. Control action shall be direct to increase the output signal to the chemical feed pumps in response to increase in the process medium pH above the set point. Controller shall include a digital display. Controller power shall be 120 V, single phase, 60 Hz. Controller enclosure shall be NEMA 4.

2.5.1. pH Indicator/Controller pH/PHC-101. The design conditions for this instrument are:

Fluid = Water pH 2 to 4 and ammonium sulfate 0 to 10%
Temperature = 0 to 40 C
pH Set Point = 2.5 ± 0.5

2.5.2. pH Indicator/Controller pH/PHC-102. The design conditions for this instrument are:

Fluid = Water pH 2 to 4 and ammonium sulfate 0 to 10%
Temperature = 0 to 40 C
pH Set Point = 2.5 ± 0.5

3. EXECUTION.

3.1. INSTALLATION. The scrubber system equipment shall be skid mounted including equipment, connecting piping and duct, valves and instruments, wiring, control panels, motor starters, and appurtenances as indicated on the Drawings. Connections shall be provided for external power source, make-up water, blowdown discharge, and sulfuric acid feed. Equipment shall be installed in accordance with the written instructions of the manufacturer. The packed towers shall be anchored for lateral stability to the stairway on Tank 102 as indicated on the Drawings.

3.2. TESTS. After installation of the scrubber systems all components of the system and the system as a whole will be subjected to operation tests to assure that the system operates properly and within the design specifications.

ZERO ACCIDENTS

SECTION 11210

CHEMICAL STORAGE TANK

INDEX

- 1. GENERAL**
- 2. PRODUCTS**
- 3. EXECUTION**

1. GENERAL.

1.1. GENERAL REQUIREMENTS

1.1.1. Standard Products. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the job site. Equipment of the same types shall each be the product of one manufacturer.

1.2. DESCRIPTION. The chemical feed tanks shall provide for storage of sulfuric acid at the job site for use in the ammonia scrubber systems. A primary storage tank and a secondary containment tank shall be provided. The primary tank shall be designed to store 50 weight percent sulfuric acid.

1.3. VERIFICATION OF DIMENSIONS. The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work. Materials and equipment shall fit into the space allotted and with adequate and acceptable clearances allowed for entry, maintenance, and operation.

1.4. SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 1300 Submittal Descriptions not later than six week prior to start of construction:

1.4.1. Materials and Equipment - GA1. Manufacturer's catalog cuts or data sheets indicating materials of construction, tank dimensions, and capacities. Drawings showing the type, size, elevation, and orientation of all connections and manways.

2. PRODUCTS.

2.1. CHEMICAL FEED TANK TK-104. Primary tank shall be a closed-top flat bottom cylindrical tank of cross-linked polyethylene construction compatible with storage of 50 percent sulfuric acid. Tank shall be of nominal 110 gallon capacity and 30 inch diameter. A 10-inch manway shall be located in the tank top. Tank shall be provided with two 1/2 inch outlet connections for connection to chemical feed pumps. Connections shall be type 316 stainless steel couplings.

Secondary containment tank shall be a open-top flat bottom cylindrical tank of cross-linked polyethylene construction compatible with storage of 50 percent sulfuric acid. Tank shall be of nominal 140 gallon capacity and 41 inch diameter.

3. EXECUTION.

3.1. INSTALLATION. Tanks delivered to the site shall be examined to confirm that they are in undamaged condition and in accordance with the approved shop drawings. Tanks shall be installed in accordance with the written instructions of the manufacturer.

3.2. TESTS. After each tank has been installed it shall be tested for leaks. The tank shall be filled with water to the top of the straight side height. The water shall be maintained at full level for 24 hours, and the tank and all joints and connections checked for leakage. All leaks discovered shall be repaired and the tank retested until there is no leakage.

ZERO ACCIDENTS

SECTION 11215

GRANULAR ACTIVATED CARBON FILTERS

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. GENERAL REQUIREMENTS

1.1.1. **Standard Products.** Granular activated carbon (GAC) air filters shall be the standard products of a manufacturer regularly engaged in the supply of such products for hazardous waste clean-up projects. The Supplier shall have facilities for acceptance of the spent GAC resulting from this project for regeneration and disposal in compliance with all applicable regulations including RCRA. The Contractor shall lease the GAC filters from the Supplier and these units including waste GAC shall be returned to the Supplier at the end of the project. All GAC and GAC filter units used for this project shall be obtained from a single supplier.

1.2. **DESCRIPTION.** The GAC filters shall be designed to remove the toxic organic and odor compounds from the gas withdrawn from the Tank 102 head space during operation of the emission control system as shown on the Drawings. The GAC filters shall use fixed beds of GAC of a type suitable for this application. Multiple GAC filter units may be required for treatment of vent gas generated during the Phases One and Two of the project. Each separate filter shall be skid mounted and shall be readily transportable as a unit.

1.3. **OPERATING REQUIREMENTS.** The GAC filters shall be designed, fabricated, installed, and operated to conform with the following operating criteria specified below. The GAC filters shall be designed and installed in a manner which prevents the release to the atmosphere of toxic organic compounds, and odors. The systems shall be rated for continuous operation and shall require a minimum of operator attention during operation. The systems will be installed and operated outdoors at the project location Rocky Mountain Arsenal, Commerce City, Colorado.

1.3.1. **Phase One Operation.** The minimum operating requirements during Phase One - Tank Content Heating and Crystal Dissolution will be:

GAC Filter Inlet Vent Gas Flow = 500 to 1300 cfm at gas temperatures of 40 to 100 F and 0 to 100% humidity.

Organic Compound Concentration Inlet Gas = 0 to 0.001 mg/liter.

Minimum Removal Efficiency for Organics = 99%

Maximum Operating Gas Pressure Differential Through GAC Filter = 7 inches water

Minimum Pressure Rating for GAC Filter = 12 inches water

1.3.2. **Phase Two Operation.** The minimum operating requirements during Phase Two - Tank Interior Decontamination will be:

GAC Filter Inlet Vent Gas Flow = 13,000 cfm at gas temperatures of 40 to 100 F and 0 to 100% humidity.

Organic Compound Concentration Inlet Gas = 0 to 0.0001 mg/liter.

Minimum Removal Efficiency for Organics = 99%

Maximum Operating Gas Pressure Differential Through GAC Filter = 6 inches water

Minimum Pressure Rating for GAC Filter = 12 inches water vacuum

1.4. **SAFETY REQUIREMENTS.** Wet GAC preferentially removes oxygen from air. If worker entry into GAC filter vessels is required for sampling or maintenance Contractor shall follow appropriate procedures for low-oxygen spaces, including all applicable Federal and State regulations.

1.5. **VERIFICATION OF DIMENSIONS.** The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise

the Contracting Officer of any discrepancy before performing the work. Materials and equipment shall fit into the space allotted and with adequate and acceptable clearances allowed for entry, maintenance, and operation.

1.6. **SUBMITTALS.** Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 1300 Submittal Descriptions not later than six weeks prior to start of construction:

1.6.1. **Materials and Equipment - GA1.** Suppliers's catalog cuts or data sheets indicating materials of construction, unit dimensions, GAC quantities, filter unit weights before and after use. Curves showing pressure drop through unit as function of air flow rate. Drawings showing the type, size, elevation, and orientation of all connections and manways. Data sheets on the type of GAC used including mesh size, hardness, apparent density, iodine number, carbon tetrachloride adsorption capacity, specific surface area, and specific pore volume. Clear and detailed information concerning procedures for return of the spent units to the supplier, including requirements for acceptance testing, copies of required shipping manifests, and units costs for return.

1.7. **SHIPPING AND DISPOSAL.** The GAC filter unit supplier shall maintain ownership of the GAC filter units used for this project. Supplier shall be responsible for removal of spent units from the site as required during the project implementation and shall be responsible for removal of all units from the site at the project end. Supplier shall return all units to supplier's facility for regeneration and disposal of GAC in compliance with all applicable regulations including RCRA.

The following RCRA listed waste codes have been assigned to GAC generated from vent gas treatment for this project: F001, F002, F003, F039, K033, K097, P051, P071, U130.

2. **PRODUCTS.**

2.1. **GAC AIR FILTERS.** GAC filter units shall be supplied as skid-mounted self-contained units including GAC. Unit design and materials of construction shall be compatible with the conditions of service. Multiple units may be used to achieve adequate capacity and to satisfy specified design conditions. GAC filters shall be of upflow design. Different sizes and designs of units may be used for the Phase One and Phase Two applications.

2.1.1. **GAC Air Filter F-101.** One or more filter units may be used for application during Phase Two of the project. The design conditions for this application are:

Air Flow Rate = 13000 cfm at 40 to 100 F and 100% humidity
Maximum Bed Velocity = 40 fpm
Minimum Bed Depth = 3 feet
Maximum Pressure Loss at Maximum Flow = 6 inches water

2.1.2. **GAC Air Filter F-102.** One or more filter units may be used for application during the Phase One of the project. The design conditions for this application are:

Air Flow Rate = 500 to 1300 cfm at 40 to 100 F and 100% humidity
Maximum Bed Velocity = 40 fpm
Minimum Bed Depth = 4 feet
Maximum Pressure Loss at Maximum Flow = 7 inches water

2.2. **GRANULAR ACTIVATED CARBON.** The GAC supplied for this project shall be a virgin coal based GAC suitable for removal of a broad range of volatile and semi-volatile organic compounds from air. The GAC shall satisfy the following requirements:

Mesh Size = 6 x 16
Iodine Number, Minimum = 1000
Carbon Tetrachloride Adsorption, Minimum, Weight % = 60
Ash, Maximum, % = 8
Moisture, Maximum, % = 2
Hardness Number, Minimum = 90
Apparent Density, Minimum, g/cc = 0.47

3. EXECUTION.

3.1. INSTALLATION. The GAC filters shall be skid mounted and shall be installed on the discharge side of the air treatment system blowers as indicated on the Drawings. After installation all connections shall be tested for leakage at the maximum operating pressure and any leaks shall be corrected and the system shall be retested.

3.2. REMOVAL. Contractor shall coordinate removal and disposal of the GAC filter units with the Supplier including any sampling and acceptance testing required. Supplier shall be responsible for removal and disposal of GAC filter units. Contractor shall include all anticipated costs in his bid, including sampling and testing.

ZERO ACCIDENTS

SECTION 11300

HEATING AND RECIRCULATION SYSTEM

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. **GENERAL.** The Contractor will provide all labor, material, equipment, and associated services to procure, fabricate, deliver to the jobsite, install, test and operate the heating and recirculation system shown on the drawings and specified herein.

1.1. **SUMMARY** (Not applicable)

1.2. **REFERENCES.** The publication and specifications listed below form a part of this specification to the extent referenced:

1.2.1. Draft Final Alternative Evaluation for Basin F Ponds and Tank Decontamination, March 1992 (Alternative Evaluation)

1.2.2. Specification Section 11305 - Heat Source

1.2.3. Specification Section 11310 - Pumps

1.2.4. Specification Section 11315 - Heat Exchangers

1.3. **SUBMITTALS.** Government approval is required for submittals with a GA designation; submittals having an FIO designation are for information only. Submittal requirements are listed in the related sections as follows:

1.3.1. Section 11305 - Heat Sources

1.3.2. Section 11310 - Pumps

1.3.3. Section 11315 - Heat Exchanges

1.4. **DELIVERY AND STORAGE.** All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variations; and dirt, dust and other contaminants.

1.5. **FIELD MEASUREMENTS.** The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

2. PRODUCTS

2.1. **GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS.** Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.1. **Nameplates.** Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a non-corrosive plate secured to the item of equipment in a conspicuous place. Such other information as the manufacturer may consider necessary to complete identification shall be shown on the name plate.

2.1.2. **Equipment Guards.** Belts, pulleys, chains, gears, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto shall be enclosed or guarded.

2.1.3. **Special Tools.** One set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall be provided.

2.1.4. **Electrical Work.** Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment and wiring shall be in accordance with Section 16000 - Electrical Specifications. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Each motor shall be of sufficient capacity to drive the equipment at the

specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices but not shown, shall be provided under this section of the specifications. Motor frames shall be of the totally enclosed type. Temperature rise shall be based on 40 degrees F. ambient temperature.

2.1.4.1. Electric Motors shall conform to NEMA 1.

2.1.4.2. Motor Controls shall conform to NEMA ICSI.

Enclosures shall be NEMA 4 Rated

2.1.5. Bolts, Nuts, Anchors, and Washers. Bolts, nuts, anchors, and washers shall be steel; galvanized in accordance with ASTM A 153.

2.1.6. Pressure Gauges. Compound gauges shall be provided on the suction side of pumps and standard pressure gauges between the pump(s) discharge and discharge headers. Gauges shall comply with ASME B40.1. Gauge ranges shall be as appropriate for the particular installation.

2.1.7. Seal Water. Pumping equipment requiring seal water shall utilize fire water.

2.1.8. Factory Test. Products shall be tested by the manufacturer or a nationally recognized testing agency in accordance with the subsections of these specifications. Certified test results will be submitted to the Contracting Officer.

3. EXECUTION

3.1. INSTALLATION. The heating and recirculation system shall be installed so as to provide a complete and integrated system in accordance with the drawings and these specifications. All equipment, except for the heat source, is to be placed within the secondary containment area for the Basin F Liquid Storage Tanks. A plastic liner is located 12 inches below the soil surface in this containment area. The Contractor shall provide supports to distribute the equipment load and exercise due care in equipment installation to prevent damage to the liner integrity.

3.2. STARTUP AND TESTING. The Contractor shall conduct operating tests to assure that the heating and recirculation system operates properly and meets the intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

3.2.1. Retesting. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

3.3. MANUFACTURER'S SERVICES. Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.4. POSTING FRAMED INSTRUCTIONS. Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

3.5. DEMOBILIZATION. The Contractor shall disassemble the heating and recirculation system at the end of Phase 2, and dispose of materials and appurtenances in accordance with Section 02073 of this specification.

ZERO ACCIDENTS

SECTION 11305

HEAT SOURCE

INDEX

- 1. GENERAL**
- 2. PRODUCTS**
- 3. EXECUTION**

1. GENERAL. The Contractor will provide a thermal fluid heat transfer system consisting of the necessary elements to deliver the heating capacity as indicated on the attached drawings and these specifications.

1.1. SUMMARY.

1.2. REFERENCES. Specification Section 11300 is a part of this specification. The publications listed below also form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.2.1. American Society of Mechanical Engineers (ASME)

ASME Sect. I	Pressure Vessel Code
ASME Sect. II	Materials
ASME Sect. V	Non Destructive Examination
ASME Section VIII	Division I
ASME Sect. X	Welding

1.2.2. Anti-Friction Bearing Manufacturers Association (AFBMA)

AFBMA 9 1990 Load Ratings & Fatigue Life for Ball Bearings

AFBMA 11 1990 Load Ratings & Fatigue Life for Roller Bearings

1.2.3. National Electric Manufacturers Association (NEMA)

NEMA ICS I 1988 Rev. 1 & 2 Industrial Controls and Systems

NEMA MG I 1987 Rev. 1 Motors and Generators

1.2.4. National Fire Protection Agency (NFPA)

NFPA 70 1990 National Electrical Code

1.3. SUBMITTAL DESCRIPTIONS.

1.3.1 SD 01 DATA GA1. Fuel-Fired Thermal Fluid Heat Transfer

System

Burner Capacity - Input; output; type; turn down ratio; flame supervision system; control method; combustion blower capacity & HP; manufacturer.

Heater - Style; material; design pressure @ temperature; refractory lining and thermal resistance; thermal efficiency.

Expansion Tank/Deaerator - Fluid Capacity, expansion capacity.

Thermal Buffer - Material and level switch connections.

Pump - Type; seal type & cooling method; maximum operating temperature; pumping capacity at the design head, motor HP & RPM; motor starter & voltage.

Instrumentation, Controls & safety devices - manufacturer, model number; range, etc.

1.3.2. SD 02 SPARE PARTS GA 2. Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than one month prior to the date of beneficial use. The data shall include a complete list of parts and supplies with current unit prices and local (within 100 miles) sources of supply.

1.3.3. SD-04 Drawings GA1. Drawings containing complete piping and wiring and schematic diagrams and any other details required to demonstrate that the system elements have been coordinated and will function as a unit. Drawings shall show the layout and anchorage of equipment and appurtenances on its skid, and relationship to other parts of the system including clearances for maintenance and operation.

1.3.4. SD-06 Instructions GA2. Diagrams, instructions, and other sheets proposed for posting.

1.3.5. SD-09 Reports GA2. Performance test reports in booklet form showing all field tests performed to adjust each component and all field

tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Test report shall indicate the final position of controls.

1.3.6. **SD-19 Operation and Maintenance Manuals GA2.** Six (6) copies of operation and six (6) copies of maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.4. **DELIVERY AND STORAGE.** See Section 11300, Par. 1.4.

1.5. **FIELD MEASUREMENTS.** See Section 11300, Par. 1.5.

2. PRODUCTS.

2.1. **GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS.** In addition to the requirements listed in Section 11300, par. 2.1, the heat transfer system shall be designed, fabricated, inspected, tested and shipped in accordance with the requirements and recommendations of the codes and standards listed in par. 1.2 (including latest addenda). Additionally, the bidder may propose furnishing this equipment or alternative equipment that meets the intent of this section on a leased basis, since this item does not come in direct contact with Basin F fluid.

2.2. **GENERAL DESCRIPTION.** The system shall be a propane-fired, thermal fluid heat transfer system; capacity in accordance with the drawings and these specifications.

The system shall be a complete package including a vertical coil design heater; combination expansion deaerator thermal buffer tank to allow for thermal fluid expansion during heatup, and to prevent oxidation of the thermal fluid during operation at temperature, even when tank is vented to atmosphere; air or water-cooled centrifugal circulating pump with mechanical seal for the operating temperatures, instrumentation and controls, and a propane supply.

2.3. **HEATER.** The heater shall produce a minimum output of 6,000,000 Btuh as measured at the thermal fluid outlet. The heater shall be supplied complete with a control panel and all required safety devices for a maximum operating temperature of 650°F. The total flow rate of the thermal fluid shall be 667 GPM. A portion of this 667 GPM may bypass the heater, but the fluid temperature leaving the heater and after mixing with the bypass fluid must be at least 300°F.

The heater shall be of a vertical, helical coil, self-venting design and the pressure vessel coil construction shall be carbon steel ASTM SA106/79B, Schedule 80 or equivalent, with a design pressure of 200 psi at 700°F. Heater will be per ASME Code Section 1, stamped at 100 psig MWP. Test pressure shall be per ASME Code Section 1. Minimal refractory lining shall be supplied in heater combustion chamber to avoid thermal inertia and overheating of the thermal fluid should a pump or power failure occur. It shall be completely factory piped, wired, and tested. Thermal efficiency shall be 85% or higher on fuel LHV.

The following instrumentation/controls/safety devices shall be supplied as a minimum requirement:

- 2.3.1. High temperature safety switch with interlocks on each tube of the coil for shutdown and alarm signal at terminal strip.
- 2.3.2. Heater operation interlock with circulation pump.
- 2.3.3. Flow control switch on each tube of the coil for shutdown of pump and burner.
- 2.3.4. Thermal fluid temperature control.
- 2.3.5. High System Pressure Switch for Complete Shutdown.
- 2.3.6. Low System Pressure Switch for Complete Shutdown.
- 2.3.7. Expansion Tank Low Level Switch for Shutdown.
- 2.3.8. Heater Outlet Pressure Gauge.
- 2.3.9. Heater Inlet Pressure Gauge.
- 2.3.10. Pump Supply (Vacuum) Gauge.
- 2.3.11. Flame safety relay.

- 2.3.12. Magnetic starters for burner and pump motors.
- 2.3.13. Three Position Selector Switch: off/pump on/heater on.
- 2.3.14. Four indicating lights:
 - 2.3.14.0.1. Pressure and flow
 - 2.3.14.0.2. Heat Demand
 - 2.3.14.0.3. Main Flame
 - 2.3.14.0.4. Alarm

2.3.15. If a portion of the thermal fluid bypasses the heater, an automatic bypass valve and temperature control is also required.

2.4. **BURNER.** The burner shall be manufactured by the heater manufacturer to assure single-source responsibility. The burner shall be forced draft and shall be an integral part of the heater, but designed for easy removal and cleaning of the burner. Burner control method shall be 3:1 modulation. Burner control shall be completely automatic, including flame supervision, fluid flow monitoring, and heater cycling.

2.5. **COMBINATION EXPANSION/DEAERATOR THERMAL BUFFER TANK.** This tank shall have capacity to hold the extra thermal fluid volume resulting from thermal expansion and be supplied complete with a liquid level switch. The total system fluid content is approximately 850 gallons, including heater, expansion/deaerator tank capacity, piping, and heat exchanger.

The combination expansion/deaerator thermal buffer tank will be constructed of carbon steel and all pipework shall be from seamless mild steel pipe conforming to ASME SA 106B or SA53A Schedule 40 or equal. It shall be supplied with expansion tank liquid level switch and 300# ANSI flanged connections.

2.6. **CIRCULATING PUMP.** The thermal fluid circulating pump shall be of centrifugal design air or water-cooled with mechanical seal designed for the system operating temperature, 667 GPM at 90 feet TDH of thermal fluid. Pump shall be complete with motor and starter.

2.7. **FUEL SUPPLY.** This system includes a propane tank and all appurtenances; capacity of at least 25000 lbs.

2.8. **FACTORY TEST.** The requirements of Section 11300, Par. 2.1.8, apply to this paragraph. The pressure vessel shall be hydrostatically tested in the presence of an inspector having a National Board Commission. This inspector shall certify a data report which shall be delivered with the heater as evidence of ASME Code compliance. In addition to the ASME symbol, the heater shall bear a National Board Registration Number.

Full electrical checks will be performed, including testing of all controls & circuitry.

2.9. **EQUIPMENT MOUNTING.** The equipment used in this system shall be skid-mounted for easy removal and relocation at the completion of this work.

3. EXECUTION.

3.1. **EQUIPMENT INSTALLATION.** The Thermal Fluid Heat Transfer System and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating system shall be provided including such items as interconnecting piping, conduit, valves, heaters, burners, pumps, drivers, power supply and controls, and fuel supply.

3.2. **PAINTING.** All parts of this system shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer.

3.3. **FIELD TESTING AND ADJUSTING EQUIPMENT.** At startup, and prior to acceptance, the contractor shall perform an operational test of the combustion system, pump, driver, and control system in accordance with Section 11300, Par. 3.2.

3.4. **MANUFACTURER'S SERVICES.** See Section 11300, Par. 3.3.

3.5. **POSTING FRAMED INSTRUCTIONS.** See Section 11300, Par. 3.4.

ZERO ACCIDENTS

SECTION 11310

PUMPS; HEATING AND CIRCULATION SYSTEM

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. **GENERAL.** The Contractor will provide all labor, materials, equipment and associated services necessary to procure, deliver to the job site, install and test the pumps shown on the drawings and as specified herein.

1.1. **REFERENCES.** Specification Section 11300 is a part of this specification. The publications listed below also form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1. American Society for Testing and Materials (ASTM). ASTM A 153, (1982, R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.1.2. American Society of Mechanical Engineers (ASME). ASME B40.1, (1985) Gauges - Pressure Indicating Dial Type - Elastic Element.

1.1.3. Anti-Friction Bearing Manufacturer's Association (AFBMA). AFBMA 9, (1990) Load Ratings and Fatigue Life for Ball Bearings; AFBMA 11 (1990) Load Ratings and Fatigue Life for Roller Bearings.

1.1.4. National Electrical Manufacturer's Association (NEMA). NEMA ICS 1, (1988; Rev 1 & 2) Industrial Controls and Systems; NEMA MG 1, (1987; Rev 1) Motors and Generators.

1.1.5. National Fire Protection Association (NFPA). NFPA 70, (1990) National Electrical Code.

1.2. **SUBMITTALS.** See Section 11300, Par. 1.3.

1.2.1 **SD-01 Data.** GA1. Heating and Circulation Pump System. Pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 110 percent of design capacity. A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

1.2.2 **SD02 Spare Parts; F.I.O.** Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than one month prior to the date of beneficial use. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

1.2.3 **SD-04 Drawings.** GA1. Heating and Circulation Pump System. Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

1.2.4 **SD-06 Instructions.** Heating and Circulation Pump System. F.I.O. Diagrams, instructions, and other sheets proposed for posting.

1.2.5 **SD-09 Reports.** FIO. Field Testing and Adjusting Equipment. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.2.6 **SD-19 Operation and Maintenance Manuals.** FIO. Heating and Circulation Pump System. Six (6) copies of operation and six (6) copies of maintenance manuals for the equipment furnished; one complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance

manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1.3. DELIVERY AND STORAGE. See Section 11300, Par. 1.4.

1.4. FIELD MEASUREMENTS. See Section 11300, Par. 1.5.

2. PRODUCTS.

2.1. GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS. The requirements of Section 11300, Par. 2.1 apply to this paragraph. Pump casings shall be constructed of fiberglass-reinforced vinyl ester resin. Impellers shall be constructed of fiberglass-reinforced vinyl ester resin coated with a 1/8-inch minimum layer of silicone carbide for moderate abrasion resistance.

2.1.1. Nameplates. The requirements of Section 11300, Par. 2.1.1, apply to this paragraph. The nameplate shall show pump capacity in gallons per minute and pumphead in feet.

2.1.2. Equipment Guards. See Section 11300, Par. 2.1.2.

2.1.3. Factory Test. The requirements of Section 11300, Par. 2.1.8, apply to this paragraph. Pumps shall be in compliance with HI-01. Where two or more identical pumps are specified, only one representative pump shall be tested.

2.1.4. Special Tools. See Section 11300, Par. 2.1.3.

2.1.5. Electric Motors. See Section 11300, Par. 2.1.4.1.

2.1.6. Motor Controls. See Section 11300, Par. 2.1.4.2.

2.1.7. Bolts, Nuts, Anchors, and Washers. See Section 11300, Par.

2.1.5.

2.1.8. Pressure Gauges. See Section 11300, Par. 2.1.6. Pressure gauges used in the piping system served by these pumps shall be complete with a diaphragm type chemical seal.

2.1.9. Seal Water Systems. The requirements of Section 11300, Par. 2.1.7, apply to this paragraph. A single mechanical seal shall be used on these pumps.

2.1.9.1. Auxiliary Equipment. Auxiliary equipment required to complete the system shall be as indicated and shall include the necessary piping, valving, pressure gauges, pressure regulators, pressure switches, strainers, and accessories.

2.1.9.2. Controls. The pressure switch shall signal an alarm and stop the process pump whenever the seal pressure is below a set point. The pressure switch and pressure regulating valve set points shall be determined by the process pump manufacturer.

2.1.9.3. System Characteristics. The seal water ahead of the pressure regulators for pump numbers P-101 and P-102 is at 50 to 57 psi.

2.2. CENTRIFUGAL PUMPS. Centrifugal pumps shall be designed to pump solids up to 1 inch in diameter and shall be of the centrifugal type for handling silt-laden fluid with a high oxidation potential.

2.2.1. Pump Characteristics. Pump numbers P-101 and P-102 shall have the following operating characteristics:

a. Pump Service: Dissolution fluid.

b. Design Operating Point: 400 gpm flow, 65 feet head, 65 to 70 percent efficiency.

c. Maximum Operating Point: 440 gpm flow, 63 feet head, 70 percent efficiency.

d. Minimum Operating Point: 360 gpm flow, 66 feet head, 63 percent efficiency.

e. Impeller Type: Centrifugal; semi-open.

f. Rotation Direction: See Drawings.

g. Operating Speed: 1150 rpm (maximum).

h. Motor Type: TEFC.

i. Electrical Characteristics: 480 volts ac, 3-phase, 60 Hz.

j. Size: Within rated load driving pump at specified rpm.

k. Pump Control: The pump shall be operated through an on-off switch at the starter. Pumps will automatically shut down on low seal water pressure. The electrical controls shall be mounted in watertight, cast-metal enclosures.

2.2.2. **Pump Casing.** The casing shall be capable of withstanding pressures 50 percent greater than the maximum operating pressures. The pump casing shall contain no openings of smaller diameter than the specified sphere size. There shall be no internal devices that will inhibit maintenance or interfere with priming and performance. The pump shall be designed to retain sufficient liquid in the casing to ensure unattended operation. The casing shall be such that the impeller can be removed without disturbing the suction and discharge connections. Front access shall be provided to the pump interior to permit inspection and cleaning of the pump interior without removing suction or discharge piping.

2.2.3. **Impeller.** The impeller shall be of the six-vane, semi-open, non-clog type. The impeller shall be statically, dynamically, and hydraulically balanced within the operating range and to the first critical speed at 150 percent of the maximum operating speed. The impeller shall be securely keyed to the shaft with a locking arrangement whereby the impeller cannot be loosened by torque from either forward or reverse direction.

2.2.4. **Pump Shaft.** Pump shaft shall be of high grade alloy steel or stainless steel and shall be of adequate size and strength to transmit the full driver horsepower with a liberal safety factor.

2.2.5. **Pump Shaft Sleeve.** The pump shaft shall be protected from wear and the corrosive properties of the fluid by a shaft sleeve that is part of and of the same material as the impeller.

2.2.6. **Seals.** The pump shaft shall be sealed against leakage by water lubricated, single balanced metallic bellows type mechanical seal, API Plan 32 with a throat bushing. Sealing member materials shall be selected by the manufacturer, bearing in mind that this highly corrosive fluid contains abrasive solids such as sand, silt and clay. The seal shall be such that the faces will not lose alignment during shock loads that cause deflection, vibration, and axial or radial movement of the pump shaft.

2.2.7. **Bearings.** Pump bearings shall be ball or roller type designed to handle all thrust loads in either direction.

2.2.8. **Lubrication.** Bearings shall be manufacturer's standard, oil or grease lubricated for this pump. A grease fitting shall be provided to add grease for grease-lubricated bearings. The grease fitting shall be of the type that prevents overlubrication and the building up of pressure injurious to the bearings. If the grease fitting is not easily accessible, grease tubing to a convenient location shall be provided.

2.2.9. **Pump Support.** A common fiberglass reinforced vinyl ester resin base plate shall be provided for the pump and motor and the base will be skid mounted together with the heat exchanger specified under Section 11315.

2.2.10. **Coupling.** Power shall be transmitted from the motor to the pump by a flexible coupling. Flexible couplings shall be of the heavy duty type, keyed or locked to the shaft. The drive assembly shall be selected on the basis of the power to be transmitted from the motor to the pump. The drive shall be enclosed on all sides by a solid metal guard.

3. EXECUTION.

3.1. EQUIPMENT INSTALLATION.

3.1.1. **Pump Installation.** Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including such items as piping, conduit, valves, mounting skids, pumps, drivers, power supply, seal water units, and controls.

3.2. FIELD TESTING AND ADJUSTING EQUIPMENT.

3.2.1. **Operational Test.** The requirements of Section 11300, Par. 3.2, apply to this paragraph.

3.2.2. **Retesting.** The requirements of Section 11300, Par. 3.2.1, apply to this paragraph.

3.3. **MANUFACTURER'S SERVICES.** The requirements of Section 11300, Par. 3.3, apply to this paragraph.

3.4. POSTING FRAMED INSTRUCTIONS. The requirements of Section 11300, Par. 3.4, apply to this paragraph.

ZERO ACCIDENTS

SECTION 11315

HEAT EXCHANGERS

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. **GENERAL.** The Contractor will provide all labor, materials, equipment and associated services to procure, deliver to the job site, install and test the heat exchangers shown on the drawings and as specified herein.

1.1. **SUMMARY.**

1.2. **REFERENCES.** Specification Section 11300 is a part of this specification. The publications listed below also form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

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| 1.2.1. American Society of Mechanical Engineers (ASME) | |
| ASME Sect. I | Pressure Vessel Code |
| ASME Sect. II | Materials |
| ASME Sect. V | Non Destructive Examination |
| ASME Section VIII | Division I |
| ASME Sect. X | Welding |

1.3. **SUBMITTALS.** See Section 11300, Par. 1.3

1.3.1. **SD01 Data; Heat Exchanger; GA1.** Total fluid quantity, pressure drop in feet of fluid, specific gravity, specific heat, viscosity, thermal conductivity and entering and leaving temperature for both fluids. The entering and leaving temperatures shall be shown at the start of the process when the dissolution fluid temperature is assumed to be 50°F and at the end of the process when the dissolution fluid temperature is at 140°F. Heat exchanged at beginning and end of process and heat exchange at 140°F. Dissolution fluid temperature, and entering heater fluid temperatures of 275°F and 250°F. Flow direction, overall heat transfer coefficient, assumed fouling resistance, net heat transfer area and percent excess area. Total fluid volume, empty and operating weight, and shipping weight and volume. Fluid velocity through exchanger and fluid passage dimensions. Design and maximum working pressure and temperature. Wetted surface material and thickness.

1.3.2. **SD02 Spare Parts; F.I.O.** Any recommended spare parts with current unit price and source of supply.

1.3.3. **SD04 Drawings - Heat Exchangers; GA1.** Drawings containing all necessary details such as connection size and location, overall exchanger dimensions, skid-mounting dimensions, proposed layout and anchorage to skids, and equipment relationship to other parts of the work including required clearance for maintenance and operation.

1.3.4. **SD06 Instructions; F.I.O.** Diagrams, instructions and other sheets proposed for posting

1.3.5. **SD09 Reports; F.I.O.** Performance test reports, in booklet form, showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Test reports shall indicate the final position of controls.

1.3.6. **SD19 Operation and Maintenance Manuals - Heat Exchangers; F.I.O.** Six (6) copies of operation and six (6) copies of maintenance manuals for the heat exchangers; one complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation and shutdown, taking into account that the dissolution fluid in the heat exchange passages is a hazardous fluid. Operation manuals shall include the manufacturer's name, model number, parts list, and a brief description of this equipment and its basic operating

features. Maintenance manuals shall list routine maintenance procedures, possible problems and repair, and a troubleshooting guide. Maintenance manuals shall include piping and equipment layout and a simplified control diagram (fluid bypass control) of the system as installed.

1.4 **DELIVERY AND STORAGE.** In addition to the requirements of Section 11300, Par. 1.4, the supplier shall coat all machined surfaces with a removable rust preventative, plug or cap all threaded connections and protect against mechanical damage during shipment.

1.5 **FIELD MEASUREMENTS.** In addition to the requirements of Section 11300, Par. 1.4, the supplier shall coat all machined surfaces with a removable dust preventive, plug or cap all threaded connections and protect against mechanical damage during shipment.

2. PRODUCTS.

2.1 **GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS.** In addition to the requirements listed in Section 11300, Par. 2.1, the heat exchangers shall be designed, fabricated, inspected, tested, and shipped in accordance with the requirements and recommendations of the codes and standards listed in Par. 1.2 (including latest addenda).

2.2 **GENERAL DESCRIPTION.** The design is based on a spiral heat exchanger with the materials of construction, fluid physical properties, and design conditions listed herein. A double pipe heat exchanger is also acceptable, but the contractor will be required to modify the installation configuration to suit the heat exchanger.

2.3 **CAPACITY.** The heat exchanger must heat 1,504,000 pounds of liquid from an initial temperature, assumed to be 50°F, to 140°F maximum in approximately 24 hours. The liquid will initially have a low salt concentration, but as the temperature approaches 140°F, the salt crystals at the bottom of Tank 102 will dissolve, thus increasing the concentration to saturation. Once the fluid reaches 140°F, or some lower temperature as directed by the RMA's representative, it will be recirculated through the heat exchanger to hold the temperature for a maximum of 5 days. It is estimated that each heat exchanger will require an initial capacity of approximately 3,250 MBtuh to meet this requirement. The physical properties of the heating and heated fluids are:

	<u>Heating Fluid</u>	<u>Heated Fluid</u>
Fluid	Thermal Oil	Dissolution fluid
Inlet temperature	300°F	50°F (initial); 140°F (final)
Maximum outlet temperature	--	160°F
Flow rate through exchanger	333 GPM	167 GPM (minimum)
Bypass flow rate	variable	233 GPM (maximum)
Pressure drop (max.)	12 psi	15 psi
Fluid sp. gravity	0.78	1.2 (at saturation)
Fluid sp. heat - Btu/#-°F	0.55	.93 (at saturation)
Fluid viscosity @ temperature	2.7 cp	4.5 cp

The dissolution fluid characteristics will not be exactly known until the system is in operation. It will be assumed, however, that the dissolution fluid is a slurry containing small insoluble and abrasive particles such as sand, silt, or clay.

2.4 **COMPONENTS.** Because the dissolution fluid is a hazardous material and the exact characteristics of the slurry are unknown, the heat exchanger shall be designed for maximum maintainability and ease of relocation and decontamination at the completion of the operation. At a minimum, the exchanger shall be complete with hinged covers, davits, A-frame mounting, and flush nozzles.

2.5. MATERIALS.

2.5.1. All materials in direct contact with the dissolution fluid shall be Hastelloy C276. The minimum spiral element thickness shall be 0.105 inches. Both heads shall be carbon steel SA-516-GR-70 lined with Hastelloy C276.

2.5.2. Nozzles shall be flanged, Schedule 40. Nozzle loads shall be negligible.

2.5.3. Head bolts shall be clamp type, "hook bolt," low alloy steel SA-193-87, with a minimum 3/4-inch bolt diameter, at a maximum of 6 inches center to center, and carbon steel SA-194-GR-2H nuts.

2.5.4. Exchanger shall have 1-inch NPT drains located at low points.

2.5.5. Head gaskets shall be full faced, Anchor 443A Aramid fiber, 1/8-inches thick, on the brine side. Thermal oil side is welded - no gasket required.

2.6. **PROCESS.**

2.6.1. Single-passage countercurrent flow.

2.6.2. Minimum channel spacing - 5/16 inch.

2.6.3. Liquid velocities shall be greater than 2 fps, and not exceed 6 fps.

2.6.4. Provide channel spacer studs in line.

2.7. **MECHANICAL.**

2.7.1. Design temperature shall be 350°F maximum and 20°F minimum.

2.7.2. Design pressure shall be 50 psig, or 10 psig greater than the maximum operating pressure.

2.7.3. The exchanger will be designed to withstand the full design pressure differential between channels

2.7.4. Provide lifting lugs on the spiral element and both covers.

2.7.5. Provide tow support saddles with holes for anchor bolts.

2.7.6. Nameplates. The requirements of Section 11300, Par. 2.1.1 apply to this paragraph. The nameplates shall show design flow in GPM and pressure drop in feet of liquid; heat exchange rate at 300°F heater fluid temperature and with dissolution fluid temperature at 40°F and 140°; heater fluid characteristics and design-heated fluid characteristics; net heat transfer area; and all other pertinent information as required by the ASME Code, Section VIII, Division 1. Mount nameplate on a "bracket" so that it is visible above the insulation and personnel will not be burned if they touch the plate.

2.7.7. Equipment Guards. Heat exchanger shall be insulated so that any person may touch the external surface without danger of being burned.

2.7.8. Special Tools. See Section 11300, Par. 2.1.3.

2.7.9. Bolts, Nuts, Anchors, and Washers. See Section 11300, Par.

2.1.5.

2.8. **FACTORY TEST.** The requirements of Section 11300, Par. 2.1.8, apply to this paragraph. Prior to shipment, each passage shall be separately hydrostatically tested in accordance with Section VIII of the ASME Code for a minimum of one hour with water and vessel at the same temperature. Other non destructive testing shall also be performed as required by law. Vessel shall be U or UM-stamped per ASME Code, Section VIII, Par. UG-120.

3. **EXECUTION.**

3.1. **HEAT EXCHANGER INSTALLATION.** Heat exchangers and appurtenances shall be skid-mounted and installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating heat exchange system shall be provided, including such items as piping and valves.

3.2. **STARTUP AND TESTING.** The requirements of Section 11300, Par. 3.2 apply to this paragraph.

3.2.1. Retesting. See Section 11300, Par. 3.2.1.

3.3. **MANUFACTURER'S SERVICES.** See Section 11300, Par. 3.3.

3.4. **POSTING FRAMED INSTRUCTIONS.** See Section 11300, Par. 3.4.

ZERO ACCIDENTS
SECTION 15260
PIPING INSULATION

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL

1.1. SECTION INCLUDES

- 1.1.1. Piping insulation.
- 1.1.2. Jackets and accessories.

1.2. PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION.

- 1.2.1. Section 15510 - Process Piping: Placement of Hangers and

Supports.

1.3. REFERENCES.

1.3.1. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

- 1.3.2. ASTM C195 - Mineral Fiber Thermal Insulation Cement.

1.3.3. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

1.3.4. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

1.3.5. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

- 1.3.6. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.

1.3.7. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

1.3.8. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

1.4. SUBMITTALS. Government approval is required for submittals with "GA" designation; submittals having an FIO designation are information only.

1.4.1. Submit under provisions of Section 01300 - Submittal Descriptions.

1.4.2. SD01 Product Data. F.I.O. Provide product description, list of materials and thickness for each service, and locations.

1.4.3. SD06 Manufacturer's Installation Instructions. F.I.O. Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.5. DELIVERY, STORAGE, AND HANDLING.

1.5.1. Deliver, store, protect, and handle products to site taking every precaution to prevent damage to the insulation material.

1.5.2. Deliver materials to site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

1.5.3. Store insulation in original wrapping and protect from weather and construction traffic.

1.5.4. Protect insulation against dirt, water, chemical, and mechanical damage.

2. PRODUCTS.

2.1. GLASS FIBER.

- 2.1.1. Insulation. ASTM C547; rigid molded, noncombustible.

2.1.1.1. 'K' Value. ASTM C335, 0.24 at 75 degrees F.

2.1.1.2. Minimum Service Temperature . -20 degrees F.

2.1.1.3. Maximum Service Temperature . 800 degrees F.

2.1.1.4. Maximum Moisture Absorption. ASTM C553 1.0

percent by volume.

2.1.1.5. Insulation thickness shall be such that the surface temperature does not exceed 105° F.

2.2. JACKETS.

2.2.1. All Weather Jackets

2.2.1.1. Jacket. Factory applied all weather jacket reinforced with 6 oz. fiberglass fabric and complete with 2" overlapping flap to close the longitudinal joints, and pressure-sensitive tape to finish the butt joints.

2.2.1.1.1. Minimum Service Temperature. -40 degrees F.

2.2.1.1.2. Maximum Service Temperature. 150 degrees F.

2.2.1.1.3. Moisture Vapor Transmission. ASTM E96; 0.2 perms.

2.2.1.1.4. Maximum Flame Spread. ASTM E84; 25.

2.2.1.1.5. Maximum Smoke Developed. ASTM E84; 50.

2.2.1.1.6. Connections. Pressure sensitive color matching vinyl tape.

3. EXECUTION.

3.1. EXAMINATION.

3.1.1. Verify that piping has been tested before applying insulation materials.

3.1.2. Verify that surfaces are clean, foreign material removed, and dry.

3.2. INSTALLATION.

3.2.1. Install materials in accordance with manufacturer's instructions on thermal fluid piping and dissolution fluid piping only.

3.2.2. On exposed piping, locate insulation and cover seams in least visible locations.

3.2.3. For insulated pipes conveying fluids above ambient temperature:

3.2.3.1. Provide all weather jackets, factory applied or field applied.

3.2.3.2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.

3.2.3.3. PVC fitting covers may be used.

3.2.3.4. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

3.2.3.5. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

3.2.4. Finish insulation at supports, protrusions, and interruptions.

3.2.5. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Cover with all weather jacket with seams located on bottom side of horizontal piping.

ZERO ACCIDENTS

SECTION 15280

EQUIPMENT INSULATION

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Equipment insulation.
- 1.1.2. Covering.

1.2. REFERENCES.

- 1.2.1. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- 1.2.2. ASTM C195 - Mineral Fiber Thermal Insulation Cement.
- 1.2.3. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- 1.2.4. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.
- 1.2.5. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- 1.2.6. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

1.3. **SUBMITTALS.** Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only.

1.3.1. Submit under provisions of Section 01300 - Submittal Descriptions.

1.3.2. SD-01 Product Data; F.I.O. provide product description, list of materials and thickness for equipment scheduled.

1.3.3. SD06 Manufacturer's Installation Instructions; F.I.O. Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.4. DELIVERY, STORAGE, AND HANDLING.

1.4.1. Deliver, store, protect and handle products to site taking every precaution to prevent damage to the insulation material.

1.4.2. Deliver materials to site in original factory packaging, labeled with manufacturer's density and thickness.

1.4.3. Store insulation in original wrapping and protect from weather and construction traffic.

1.4.4. Protect insulation against dirt, water, chemical, and mechanical damage.

1.4.5. Tie Wire. 18 gauge (1.2 mm) stainless steel with twisted ends on maximum 12-inch (300 mm) centers.

2. PRODUCTS.

2.1. GLASS FIBER.

2.1.1. Insulation. ASTM C553; resilient, flexible, noncombustible.

2.1.1.1. 'K' Value. ASTM C177, 0.23 at 75° F.

2.1.1.2. Maximum service temperature. 450° F.

2.1.1.3. Maximum moisture absorption. ASTM C553 1.0 percent by volume.

2.1.1.4. Density. 3.0 lb/cu ft.

2.1.2. Facing. 1-inch galvanized steel, hexagonal wire mesh stitched on one face of insulation.

2.2. JACKETS.

- 2.2.1. Jacket.** ASTM C921, field-applied, non-metallic, all-weather jacket.
- 2.2.1.1. Minimum service temperature.** -40° F.
- 2.2.1.2. Maximum service temperature.** 150° F.
- 2.2.1.3. Moisture Vapor Transmission.** ASTM E96; 0.002 perm inches.
- 2.2.1.4. Maximum Flame Spread.** ASTM E84; 25.
- 2.2.1.5. Maximum smoke developed.** ASTM E84; 50.
- 2.2.1.6. Connections.** Pressure sensitive, color-matching vinyl tape.

3. EXECUTION.

3.1. EXAMINATION.

- 3.1.1.** Verify that equipment has been tested before applying insulation materials.
- 3.1.2.** Verify that surfaces are clean, foreign material removed, and dry.

3.2. INSTALLATION.

- 3.2.1.** Install materials in accordance with manufacturer's instructions on the heat exchangers and thermal fluid pumps.
- 3.2.2.** Do not insulate factory insulated equipment (The thermal fluid heater is assumed to be pre-insulated by the manufacturers).
- 3.2.3.** On exposed equipment, locate insulation and cover seams in least visible locations.
- 3.2.4.** Apply insulation close to equipment by grooving, scoring, and bevelling insulation. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- 3.2.5.** Fill joints, cracks, seams, and depressions with bedding compound to form a smooth surface.
- 3.2.6.** For insulated equipment containing fluids above ambient temperature:
- 3.2.6.1.** Provide standard jackets, factory-applied or field-applied.
- 3.2.6.2.** For hot equipment containing fluids 140° F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- 3.2.6.3.** For hot equipment containing fluids more than 140° F, insulate with flanges and unions with removable sections and jackets.
- 3.2.7.** Finish insulation at supports, protrusions, and interruptions.
- 3.2.8.** Cover with non-metallic, all-weather jacket with seams located on bottom side of horizontal equipment.
- 3.2.9.** Do not insulate over nameplate or ASME stamps.
- 3.2.10.** Install insulation for equipment requiring access for maintenance, repair, or cleaning, in such a manner that it can be easily removed and replaced without damage.

ZERO ACCIDENTS

SECTION 15510

PROCESS PIPING

INDEX

- 1. GENERAL
- 2. PRODUCTS
- 3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Pipe and pipe fittings for:
 - 1.1.1.1. Thermal fluid piping system.
 - 1.1.1.2. Brine piping system.
 - 1.1.1.3. Scrubber water piping system.
 - 1.1.1.4. Utility water piping.
 - 1.1.1.5. Equipment drains and overflows.
 - 1.1.1.6. Chemical feed piping.

- 1.1.2. Valves
 - 1.1.2.1. Diaphragm valves.
 - 1.1.2.2. Gate valves.
 - 1.1.2.3. Needle valves.
 - 1.1.2.4. Globe valves.
 - 1.1.2.5. Ball valves.
 - 1.1.2.6. Check valves.
 - 1.1.2.7. Solenoid valves.

1.2. RELATED SECTIONS.

- 1.2.1. Section 11220 - Scrubbers.
- 1.2.2. Section 11305 - Heat Source.
- 1.2.3. Section 11310 - Pumps; Heating and Circulation System.
- 1.2.4. Section 11315 - Heat Exchangers
- 1.2.5. Section 15260 - Piping Insulation.

1.3. REFERENCES. The publications listed below form a part of this specification to the extent referenced.

1.3.1. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

1.3.2. ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.

1.3.3. ASME B31.3 - Chemical Plant and Petroleum Refinery Piping

1.3.4. ASME B31.9 - Hydrostatic Design Stresses - Non-Metallic Pipe.

1.3.5. ASME B36.10 - Welded & Seamless Wrought Steel pipe

1.3.6. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.

1.3.7. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

1.3.8. ASTM D1785 - PolyVinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.

1.3.9. ASTM D2104 - Polyethylene Plastic Pipe, Schedule 40.

1.3.10. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.

1.3.11. ASTM D2464 - PolyVinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.

1.3.12. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

1.3.13. ASTM D2996 - Filament Wound Reinforced Thermosetting Resin Pipe (FRP).

- 1.3.14. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- 1.3.15. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- 1.3.16. AWS A5.8 - Brazing Filler Metal.
- 1.3.17. AWS D1.1 - Structural Welding Code.
- 1.3.18. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
- 1.3.19. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- 1.3.20. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- 1.4. SYSTEM DESCRIPTION.
- 1.4.1. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- 1.4.2. Use flanges at valve equipment and apparatus connections.
- 1.4.3. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- 1.4.4. Provide pipe hangers and supports in accordance with MSS SP69, unless indicated otherwise.
- 1.4.5. Use diaphragm valves with lined straightaway bodies for brine and gate or ball valves for water source for shutoff, and to isolate equipment, part of systems, or vertical risers.
- 1.4.6. Use diaphragm valves with weir-type lined bodies for brine, and globe or ball valves for water service for throttling, bypass, or manual flow control services.
- 1.4.7. Use spring-loaded check valves on discharge of scrubber water pumps.
- 1.4.8. Use 1-1/2 inch gate valves with plug for drains at main shutoff valves, low points of piping, bases of vertical risers, and at equipment.
- 1.5. SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with section 01300 - Submittal Descriptions.
- 1.6. SD01 DATA-PIPE AND FITTINGS; FIO.
- 1.6.1. Product Data. Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer's catalogue information. Indicate valve data and ratings.
- 1.6.2. Welder's Certificate. Include welder's certification of compliance with AWS D1.1.
- 1.7. SD06 INSTRUCTIONS - PIPE & FITTINGS-FIO
- 1.7.1. Manufacturer's Installation Instructions. Indicate hanging and support methods, joining procedures.
- 1.8. REGULATORY REQUIREMENTS.
- 1.8.1. Conform to ASME B31.9 code for installation of piping system.
- 1.8.2. Welding Materials and Procedures. Conform to ASME SEC 9 and applicable state labor regulations.
- 1.8.3. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.
- 1.9. DELIVERY, STORAGE, AND HANDLING.
- 1.9.1. Deliver, store, protect, and handle products to site, taking every precaution to prevent damage to the pipe, valves, and fittings.
- 1.9.2. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- 1.9.3. Provide temporary protective coating on cast iron and steel valves.
- 1.9.4. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9.5. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.10. VERIFICATION OF DIMENSIONS. All dimensions essential to the correct location of piping at equipment and valves, or to the avoidance of obstructions or conflict with other improvements, shall be accurately determined by the Contractor, prior to fabrication of the piping involved. Any required change from normal locations shown on the drawing shall be made by the Contractor and shall be included as part of the work hereunder and will be subject to the approval of the Corps of Engineers.

2. PRODUCTS.

2.1. THERMAL FLUID PIPING, ABOVE GROUND. For piping installed between the heat source and heat exchanges and including the equipment drains: standard no. D-06-F:

2.1.1. Pipe material - ASTM A53, schedule 40, carbon steel, black.
2.1.2. Fittings - ANSI B16.9, seamless, ASTM A234, Grade WPB, butt weld.

2.1.3. Flanges - ANSI B16.5, Class 150, forged carbon steel, ASTM A105, RF.

2.1.4. Joints - Butt welded and flanged at valves and equipment.

2.1.5. Valves - Gate and control.

2.2. DISSOLUTION FLUID PIPING, ABOVE GROUND, EXTERNAL TO TANK 102. (including piping and equipment drains) Standard No. D-06-K:

2.2.1. Pipe material - ASTM D2997 classification of RTRP, Type 11, Grade 1 Class C, Fiberglass.

2.2.2. Fittings - ASTM D1599, Epoxy Resin.

2.2.3. Flanges - ANSI B16.1 and ANSI B16.5.

2.2.4. Joints - Adhesive sockets and adhesive suitable for the temperature.

2.2.5. Valves - Diaphragm, and Ball.

2.3. DISSOLUTION FLUID PIPING, INSIDE TANK 102. Standard no. P. This pipe will serve as a fluid distribution header to be furnished with two 5/8" holes, equally spaced along each header (approx. 36") at 15° below the horizontal axis (total of 52 holes).

2.3.1. Pipe Material - ASTM D-3035 and F714, HDPE, SDR 11.

2.3.2. Fittings - Molded, butt ends, pressure rating equal to or greater than pipe.

2.3.3. Flanges - ANSI B16.5, Class 150.

2.3.4. Joints - thermal butt fusion method.

2.4. SCRUBBER WATER PIPING, ABOVE GROUND

2.4.1. Pipe Material - ASTM D1785 Schedule 80, PVC.

2.4.2. Fittings - ASTM D2467, schedule 80 PVC, socket type.

2.4.3. Flanges - ANSI B16.5, Class 150, metal.

2.4.4. Joints - D2467, socket type, solvent welded.

2.4.5. Valves - Ball, butterfly and check, cell class 12454-B per ASTM 1784.

2.5. UTILITY WATER PIPING, ABOVE GROUND. Standard no. D-06-C.

2.5.1. Pipe Material - ASTM A120 Schedule 40, carbon steel, galvanized.

2.5.2. Fittings - ANSI B16.3,, Class 300, galvanized, malleable iron, screwed.

2.5.3. Flanges - ANSI B16.1, Class 125, cast iron, flat faced, screwed.

2.5.4. Joints - Threaded.

2.5.5. Valves - Ball, needle and solenoid, Standard no. D-06-C.

2.6. UTILITY WATER PIPING, BURIED. Standard no. D-06-C.

2.6.1. Pipe Material - ASTM A120, Schedule 40, carbon steel, galvanized with double layer, 10 mil polyethylene tape, half lapped.

2.6.2. Joints - Threaded.

2.7. CHEMICAL FEED PIPING.

2.7.1. Pipe Material - ASTM 2104, Schedule 40, polyethylene continuously supported by light-weight channels.

2.7.2. Fittings - ASTM P2609 and D2683.

2.7.3. Joints - ASTM D3261, butt heat fusion.

2.7.4. Valves - Ball, polypropylene, threaded.

2.8. PIPE HANGERS AND SUPPORTERS.

2.8.1. The Contractor shall provide sleepers, saddles, clamps, brackets, pipe hangers and other supports as necessary to support all dead load, live load, and dynamic load experienced by the piping and appurtenances. Pipe supports conforming to these requirements shall be supplied whether or not shown on the drawings. Supports shall be provided at, but not limited to, points of change in direction, both sides of flexible joints, dead ends and at maximum spacing as defined by this specification. In general, all piping shall be supported from the ground on "sleepers."

2.8.2. Support requirements for the distribution header inside of Tank 102 must be determined upon removal of the manhole covers. Bid shall be based on the assumption that solid material is at or just below the manhole level and that the header will be supported by the solid material as it is inserted into the tank.

2.8.3. Design. Supports shall be adequate to maintain the pipe lines apparatus and equipment in proper position and alignment under all operating conditions. Sufficient supports shall be installed to provide a working safety factor of 12, assuming the pipe is filled with water.

2.8.4. Supports for FRP Piping. Fiberglass-reinforced plastic (FRP) will normally be supported by the same type of supports used with steel pipe, except that in no instance will C-Clamp or other point-bearing supports be allowed. Riser Clamps, if required, shall be full circumferential type only. Support spacing shall be based on the FRP pipe manufacturer's recommendations for the service conditions. Pipe operating at temperatures high enough to materially lower its strength shall be supported continuously by light metallic angles or channels.

2.8.5. Anchors. Shall be furnished and installed where required for holding the pipe lines and equipment in alignment or position. The design of all anchors will be subject to approval by the Corps of Engineers.

3. EXECUTION.

3.1. GENERAL INSTALLATION.

3.1.1. The different kinds of buried and aboveground piping shall be installed in accordance with the Drawings and procedures and methods submitted with the approved shop and erection drawings. Such procedures and methods shall conform to or exceed the minimum requirements of the pipe manufacturer and shall be as supplemented by the provisions specified herein. The interior of the pipe, fittings, and couplings shall be clean and free from contamination when installed. Effective means shall be taken to prevent the entrance of foreign matter following installation. Where fittings are omitted from the Drawings, they shall be the same size as the piping and in, all cases, shall conform to the applicable code requirements.

3.1.2. All pipe shall be carefully placed and supported at the proper lines and grades and, where practicable, shall be sloped to permit complete drainage. Piping runs shown on the drawings shall be followed as closely as possible, except for minor adjustment to avoid architectural and structural features. If relocations are required, they shall be subject to the approval of the Corps of Engineers.

3.2. BURIED PIPING INSTALLATION.

3.2.1. Buried piping shall be laid to the grades and alignment shown on the drawings, and all trenching, bedding, and backfilling shall conform to the following sections of AWWA Standard C600:

Section 2	"Inspection, Receiving, Handling, and Storage"
Section 3.1	"Alignment and Grade"
Section 3.3	"Pipe Installation"

Section 3.4	"Joint Assembly"
Section 3.6	"Valve and Fitting Installation"
Section 3.8	"Thrust Restraint"

3.2.2. The foregoing requirements shall govern the work, regardless of the type of pipe installed, unless a more stringent requirement is specified. When the work is not in progress, open ends of pipe and fittings shall be securely closed. The piping shall be placed when trench and weather conditions are suitable. No pipe shall be laid in water, and responsibility for the diversion of drainage and requirements shall be borne by the Contractor. All pipe in place shall be approved by the Corps of Engineers as to line, grade, bedding, and proper joint construction before backfilling. In all backfilling operations, the Contractor shall be responsible for preventing damage to or misalignment of the pipe.

3.2.3. Joint Installation. Installation of joints and couplings for buried piping shall conform to the following requirements:

3.2.3.1. Joints of all sizes shall conform to the applicable requirements specified hereinafter for aboveground piping. Care shall be taken to keep pipe in correct alignment when making joints. The "popping-on" of joints will not be permitted.

3.2.3.2. Restrained-type joints shall be provided at all joints of pipe with specials and fittings in piping of lower pressure rating.

3.2.3.3. Flanges, galvanized flange bolts, and other exterior surfaces of restrained joints and flanged couplings shall be given two coats of a coal-tar base coating suitable for this purpose. Where coatings of pipe and valves or appurtenances do not lie in the same plane, the offset shall be filled gradually with a suitable epoxy putty to provide a smoothly continuous joint.

3.2.4. Coverage. Unless otherwise shown on the drawings, all buried piping shall have a coverage of at least 36 inches between the top of the pipe and the finished surface, and all buried conduits shall have a coverage of at least 24 inches between the top of the pipe and finished surface. Variations from the pipeline grade and alignment may be allowed to accommodate fabrication, with the approval of the Corps of Engineers. All changes of grade shall require the approval of the Corps of Engineers on the installation drawings.

3.2.5. Buried FRP shall be marked by a continuous 6-inch-wide warning tape. The warning tape shall be specifically designed for direct burial and shall be made of inert plastic film inseparably bonded to a metalized core, permitting detection by a metallic pipe locator. The tape shall be yellow or orange in color and shall be imprinted "Buried Pipeline Below" in large block black lettering, repeated at not more than 36-inch intervals.

3.3. ABOVEGROUND PIPING INSTALLATION.

3.3.1. All piping shall be installed in accordance with the erection drawings and the erection procedure submitted with the approved shop or erection drawings. The horizontal piping shall be level except where otherwise shown or specified; parallel lines shall be grouped on the same horizontal or vertical plant wherever possible. Vertical piping shall be plumb, and the entire piping configuration shall allow adequate clearances for convenient access for preventive maintenance of valves. Piping shall clear obstruction, preserve headroom, and keep openings and passageways clear. If structural difficulties or other work prevent the running of pipes or the setting of equipment at the point indicated on the drawings, the necessary minor deviations therefrom, as determined by the Corps of Engineers, will be allowed and shall be shown on the erection drawings to be furnished. Except as otherwise shown or specified, piping installation work shall conform to the requirements of ANSI B31.1.0 and the printed or written recommendations of the manufacturer of the product involved for the given conditions.

3.3.2. Joints. Installation of joints and couplings shall conform to the following requirements:

3.3.2.1. Joints and Couplings. Joints and couplings shall be made in accordance with the specified requirements made part of the erection procedure submitted by the Contractor.

3.3.2.2. **Flanged Joints.** Flanged joints shall be made with gaskets centered in the joint. Bolts, studs, and nuts shall be lubricated with graphite and oil so that the nuts can be turned by hand. Care shall be taken to prevent excessive initial tension to the bolt and studs and to ensure that the tension applied is as nearly uniform as possible. The rust preventive compound applied to the faces of flanges before shipment shall be removed before installation. Where slip-on flanges are used on ferrous metal pipe, they shall be fillet-welded to the pipe on both front and back sides.

3.3.2.3. **Electrical insulation joints** shall be provided at all connections between ferrous and non-ferrous pipe, except where the non-ferrous pipe is an electrical non-conductor. The joints shall be tested after completion to verify non-conductivity.

3.3.2.4. **PVC pipe joints at fittings and couplings** to valves and equipment shall be made in accordance with the manufacturer's printed instructions.

3.4. **INSTALLATION OF PLASTIC PIPE.**

3.4.1. **FRP pipe** shall be installed as shown on the Drawings.

3.4.2. **Fittings.** Fittings for FRP pipe shall be flanged, solvent-welded, or epoxy adhesive-welded, unless otherwise shown on the Drawings or noted herein. Transition from plastic to steel pipe shall be by flanges or by threaded slip joint, plastic adapter or fitting. Teflon tape or other similar inert products shall be used in threaded connections.

3.4.3. **Anchorage.** All line valves and fittings at downpipes shall be anchored in a manner to prevent stress and rotation of pipe.

3.4.4. **Joints.** Joint material shall conform strictly to the printed recommendations of the pipe manufacturer and as stated herein. Flanges shall be installed on pipe in accordance with the manufacturer's instructions. Flange faces shall be perpendicular with the pipe axis.

3.5. **CHANGES IN LINE AND GRADE.**

3.5.1. In the event that obstructions not shown on the Drawings are encountered during the progress of the work which will require alterations to the drawings, the Corps of Engineers will have the authority to change the drawings and order the necessary deviations from the line or grade. The Contractor shall not make any deviation from the specified line or grade without approval by the Corps of Engineers. Should any deviation in line or grade be permitted by the Corps of Engineers for the convenience of the contractor, any additional costs for thrust blocks, valves, blow-off assemblies, extra pipe footage, or other additional costs shall be borne by the Contractor.

3.6. **INSTALLATION OF STEEL PIPE.**

3.6.1. **Steel pipe** shall be installed as shown on the drawings. Horizontal and vertical pipe shall be anchored securely by means of pipe hangers or supports. Sufficient unions shall be provided to facilitate disassembly of the pipe. Pipe ends shall be reamed to the full bore of the pipe. Threads shall conform to the requirements of ANSI B2.2-1968. In making up threaded joints, teflon tape shall be applied to the male ends only.

3.7. **TESTING.**

3.7.1. All piping shall be tested pneumatically. Air pressure of 15 pounds per square inch shall be applied to piping and fittings. There shall be no drop in pressure in a 2-hour period. Temperature correction may be used when testing pipe and changes in ambient temperatures occur. (i.e., $P_2 = P_1 \times T_2/T_1$). Leaks shall be located and repaired to the satisfaction of the Corps of Engineers.

3.8. **DEFECTIVE WORK.** If inspection or test shows defects, such defective work or material shall be replaced or repaired, as necessary, and inspections and tests shall be repeated. Repairs to piping shall be made with new materials. No caulking or screwed joints or holes will be acceptable.

3.8.1. **Equipment and Supplies.** The Contractor shall provide all equipment and supplies for performing the work and shall waste the water at locations or by procedures approved by the Corps of Engineers. The Contractor shall be responsible for furnishing fittings and any special pipe taps where required for injecting sterilizing solution.

	Woodward-Clyde Engineering Specification		Standard Number D-06-K		
By: W. W. Irving Approved: _____	Piping Material Specification		Page 1 of 2		
			Issued: June 1, 1992		
Revised: _____					
Recommended service: Dissolution fluid.					
Maximum allowable pressure (psi) at 225 degrees F.					
Nominal Size Inches	Pipe	Socket Ftgs.	Flanged Ftgs.	Fittings (Note 1) Flanges	Laterals Crosses Saddles
1 1/2	300	450	150	450	-
2	200	450	150	450	125
3	200	300	150	300	125
4	175	225	150	225	100
6	150	225	150	225	100
8	150	225	150	225	100
10	150	225	150	225	75
12	150	225	150	225	75
14	150	125	150	150	-
<u>PIPE MATERIAL</u>		<u>DESCRIPTION</u>			
1 1/2" thru 14"		Centrifugally cast reinforced thermosetting per ASTM D 2997 classification of RTRP Type II, Grade 1, Class C. Minimum 30 mil pure resin corrosion barrier, bell or plain ends. Pipe shall be Fibercast Centricast III EP or an approved equal.			
<u>VALVES</u>					
1/2" thru 2"		Ball, union style, CPVC body and ball, Buna "N" o-rings, threaded, Asahi/America or an approved equal.			
1 1/2" through 8" (Note 2)		Check, horizontal swing, PVDF body, Buna "N" o-rings, flanged, ASA 150 lb. pattern, Asahi/America or approved equal.			
		Diaphragm, straightway body, cast iron, Buna "N" lining and diaphragm, flanged, 125 lb. pattern, ITT "Dia Flo" or approved equal.			
		Diaphragm weir body, cast or ductile iron, Buna "N" lining and diaphragm, flanged, 125 lb. pattern, ITT "DiaFlo" or approved equal.			
10" thru 12" (Note 2)		Diaphragm, straightway body, cast iron, Buna "N" lining and diaphragm, flanged, 125 lb. pattern, ITT "Dia-Flo" or approved equal.			
		Diaphragm, weir body, cast iron, Buna "N" lining and diaphragm, flanged, 125 lb. pattern, ITT "Dia-Flo" or approved equal.			
<u>FITTINGS</u>					
1" thru 14"		Epoxy resin fittings as available in Fibercast fittings catalog FC-665, R 3/90.			
<u>FLANGES</u>					
1 1/2" thru 14"		Socket-type, dimensionally meet ANSI B16.1 125 lb. and ANSI B16.5 150 lb., epoxy resin, Fibercast Figure 18 or approved equal.			

	Woodward-Clyde Engineering Specification	Standard Number D-06-K
By: W. W. Irving	Piping Material Specification	Page 2 of 2
Approved: _____		Issued: June 1, 1992
		Revised: _____

BRANCH

CONNS.

1" & smaller

Schedule 80 (ASTM F441), CPVC (chlorinated polyvinyl chloride, Type IV, Grade 1, Class 23477-B) in accordance with ASTM D1784.

1 1/2" thru 14"

Standard epoxy resin fittings as available in Fibercast catalog FC-665, R 3/90.

BOLTS

1" thru 14"

Hex machine bolts, ASTM A307 Grade B with heavy hex nuts.

(Note 3)

GASKETS

1" thru 14"

1/8" thick, Buna "N", full face type, hardness of 50 - 70 durometer (Shore A).

NOTES:

- For insulated and/or heat traced areas, use 100% of uninsulated piping recommendations up to 200 degrees F and reduce these ratings 50% for 225 degrees F operating temperatures.
- Valve maximum operating pressures at 160 degrees F are:

Size	Check Diaphragm (PVDF)	Diaphragm (Buna "N") (Straight- away)	Diaphragm (Buna "N") (Weir Body)
1 1/2"	120	94	158
2"	120	94	158
2 1/2"	100	90	136
3"	100	90	136
4"	85	75	133
6"	70	48	112
8"	50	42	91
10"	N/A	34	59
12"	N/A	34	59

- Use SAE standard washers under all nuts and boltheads.

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By: W. W. Irving	Piping Material Specification	Page 1 of 2
Approved: _____		Issued: 7-2-92
		Revised: _____

Recommended Service: Natural Gas.

Maximum allowable pressure and temperature:

Temperature, degrees F	100	150	200	250	300	350
Pressure, PSIG	285	272	260	245	230	215

<u>PIPE</u>	<u>DESCRIPTION</u>
1/2" thru 10"	Schedule 40, ASTM A53 Grade A or B, seamless carbon steel.
12" thru 24"	Standard (0.375" W.T.), ASTM A53 Grade B, seamless carbon steel.

<u>VALVES</u>	
2" & smaller	Ball, carbon steel, socket weld, Worcester Fig. No. 46TT or approved equal (max 300 degrees Fahrenheit).
	Check, carbon steel, socket weld, piston, Anvil Fig. No. 4021 or approved equal.
	Gate, carbon steel, socket weld, Vogt Fig. No. SW-12111 or approved equal.
	Globe, carbon steel, socket weld, Jenkins Fig. No. 8G80W or approved equal.
	Plug, carbon steel, screwed, lubricated, Walworth Fig. No. 1748 or approved equal.
	Control, Converging flow, Class 150, flanged, 300°F fluid temperature, Fisher Design YS, with 115/1/60 motorized actuator, 4-20 mA signal, N.O. to bypass, C _v = 112.
2 1/2" & larger	Butterfly (lug), Class 150, carbon steel, Jamesbury Fig. No. 815L or approved equal.
	Check, Class 150, carbon steel, flanged, swing, Jenkins Fig. No. 1025-B2 or approved equal.
	Globe, Class 150, carbon steel flanged, Jenkins Fig. No. 1040-B or approved equal.
	Plug, Class 150, carbon steel, flanged, lubricated, Powell Fig. No. 1559 (1"-4"), 1559-G (6"-12").

<u>FITTINGS</u>	
1 1/2" & smaller	ANSI B16.11 Class 3000 forged carbon steel, ASTM A105, socket weld.
2" & larger	ANSI B16.9 seamless ASTM A234 Grade WPB, butt weld, same sch. as pipe.

<u>FLANGES</u>	
1 1/2" & smaller	ANSI B16.5 Class 150 forged carbon steel, ASTM A105, RF, socket weld, same sch. as pipe.
2" & larger	ANSI B16.5 Class 150 forged carbon steel, ASTM A105, RF, slip-on.

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By: W. W. Irving	Piping Material Specification	Page 2 of 2
Approved: _____		Issued: 7-2-92
		Revised: _____
<p><u>UNIONS</u></p> <p>1 1/2" & smaller Class 3000 forged carbon steel, socket weld, ASTM A105, steel/steel seats.</p> <p>2" & larger Flanges as specified above</p> <p><u>BRANCH CONNS.</u></p> <p>1 1/2" & smaller Socket weld tee. (Use insert for reducing.)</p> <p>2" & larger Full Size Branch: Tee Branch 2 1/2" & Larger: Stub-in Branch 2" & Smaller:</p> <p><u>BOLTS</u> (All sizes) Alloy bolt studs, ASTM A193 Grade B7 with hex nuts to ASTM A194 Grade 2H, heavy weight.</p> <p><u>GASKETS</u> ANSI B16.5 Class 150 spiral wound gaskets with 304 stainless steel and non-asbestos (Chlorite Mineral) filler and 1/8" carbon steel compression gage rings.</p>		

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By: W. W. Irving	Piping Material Specification	Page 1 of 2
Approved: _____		Issued: June 1, 1992
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Service: Utility water (galvanized).

Maximum allowable pressure and temperature:

Temperature, degrees F	100	150	200	220
Pressure, PSIG	125	100	75	50

<u>PIPE</u>	<u>DESCRIPTION</u>
1/2" thru 4"	Schedule 40, ASTM A120, galvanized carbon steel.
4" thru 6"	Schedule 40, ASTM A53 Grade B, black carbon steel.

VALVES

2" & smaller Ball, bronze, screwed, Worcester Fig. No. 4211T or approved equal.

 Check, bronze, screwed, swing, Jenkins Fig. No. 762A or approved equal.

 Gate, bronze, screwed, Jenkins Fig. No. 270C or approved equal.

 Globe, bronze, screwed, Crane Fig. No. 70 or approved equal.

 Needle, brass, screwed, Hoke Series 3900, Fig. No. 3912F8B, or approved equal.

 Solenoid, brass, screwed, Buna N Disk, 115/1/60, normally closed, Type 3R, ASCO Red Hot or approved equal. In service to:

 D-101 Cat. No. 8221 G7, 1" NPT with 1" orifice, C_v = 11.5.

 D-102 Cat. No. 8030 G3, 3/4" NPT with 3/4" orifice, C_v = 5.

2 1/2" & larger Butterfly, Class 125, cast iron, lug, Keystone Fig. No. 122 or approved equal.

 Check, Class 125, cast iron, flanged, swing, Crane Fig. No. 373 or approved equal.

 Gate, Class 125, cast iron, flanged, Jenkins Fig. No. 651-A or approved equal.

 Globe, Class 125 cast iron, flanged, Jenkins Fig. No. 613 or approved equal.

FITTINGS

(All sizes) ANSI B16.3, Class 300, galvanized malleable iron, screwed.

FLANGES

(All sizes) ANSI B16.1, Class 125, cast iron, flat face, screwed.

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By: W. W. Irving	Piping Material Specification	Page 2 of 2
Approved: _____		Issued: June 1, 1992
		Revised: _____
<p><u>UNIONS</u> (All sizes) ANSI Class 300, galvanized malleable iron, screwed, bronze-to-iron seat.</p> <p><u>BRANCH CONNS.</u> (All sizes) ANSI B16.3, Class 300, galvanized malleable iron, screwed reducing tee.</p> <p><u>BOLTS</u> (All sizes) Hex head machine bolts, ASTM A307 Grade B, with heavy hex nuts.</p> <p><u>GASKETS</u> (All sizes) 1/16" compressed non-asbestos with SBR binder, full face type in accordance with ANSI B16.21, Garlock Style 3400 or Engineer approved substitute.</p>		

	Woodward-Clyde Engineering Specification	Standard Number P
By: W. W. Irving	Piping Material Specification	Page 1 of 1
Approved: _____		Issued: June 1, 1992
		Revised:

Recommended Service: Distribution header for Basin F fluid.

<u>Pipe</u>	<u>Description</u>
2" and 3"	SDR 11 coils, Ultra-high molecular weight, high density polyethylene pipe meeting ASTM D3035 and F714, Plexco EHMW 3408, Driscopipe 8600 or approved equal.
4" and 6"	SDR 11, 40 foot straight lengths, Ultra-high molecular weight, high density polyethylene pipe meeting ASTM D3035 and F714, Plexco EHMW 3408, Driscopipe 8600 or approved equal.

Fittings

2" thru 6"	Molded, pressure rating equal to or better than pipe, butt ends, Ultra-high molecular weight, high density polyethylene, Plexco, Driscopipe or approved equal.
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Flanges

2" thru 6"	ANSI B16.5, Class 150, epoxy coated steel, lap joint style, for use with flange adapters as furnished by the pipe manufacturer.
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Bolts

All Sizes	Hex head machine bolts, 304 stainless steel, with heavy hex nuts.
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Gaskets

All Sizes	1/16" Neoprene, ring type, JM Style 103 or approved equal.
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Joining Method

All Sizes	Pipe and fittings shall be machine joined by the thermal butt fusion method as recommended by the pipe manufacturer.
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ZERO ACCIDENTS

SECTION 15890

DUCTWORK

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Metal ductwork.

1.2. RELATED SECTIONS.

- 1.2.1. Section 15910 - Ductwork Accessories.

1.3. REFERENCES.

- 1.3.1. ASTM A 36 - Structural Steel.
- 1.3.2. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- 1.3.3. SMACNA - Round Industrial Duct Construction Standards.
- 1.3.4. SMACNA - HVAC Duct Construction Standards - Metal and

Flexible.

1.3.5. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.

- 1.3.6. UL 181 - Factory-Made Air Ducts and Connectors.

1.4. PERFORMANCE REQUIREMENTS.

1.4.1. No variation of duct configuration or sizes permitted except by written permission.

1.5. SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only.

1.5.1. Submit under provisions of Section 01300 - Submittal Description.

1.5.2. SD-01 Product Data. F.I.O. Provide data for duct materials and duct connectors.

1.5.3. SD-04 Shop Drawings; F.I.O. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

1.6. QUALITY ASSURANCE.

1.6.1. Perform Work in accordance with SMACNA - Round Industrial Duct Construction Standards.

1.7. QUALIFICATIONS.

1.7.1. Manufacturer. Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.7.2. Installer. Company specializing in performing the work of this section with minimum three years experience.

1.8. ENVIRONMENTAL REQUIREMENTS.

1.8.1. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

2. PRODUCTS.

2.1. MATERIALS.

2.1.1. Aluminum Duct. ASTM B209; Aluminum Sheet, Alloy 3003-H14. Aluminum connectors and bar stock: Alloy 6061-T6 or of equivalent strength. The duct system to be fabricated for this installation will have two distinct service requirements: a 13,000 cfm system that will operate at ambient air conditions and a 1300 cfm system that will operate at 140°F (max). Material selection shall be based on the requirements as follows:

Duct Size	13,000 cfm			1300 cfm		
	Press "wg	Vel. fpm	Temp °F	Press "wg	Vel. fpm	Temp °F
28" dia.	-5"	3050	AMB	- 0.5"	320	140° max
10" dia.	--	--	--	-2.5 to +11.0	2500	110° (approx.)

2.1.2. Hanger Rod. ASTM A36; steel, galvanized, threaded both ends, threaded one end, or continuously threaded.

2.2. DUCTWORK FABRICATION

2.2.1. Fabricate and support in accordance with SMACNA Round Industrial Duct Construction Standards, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

2.2.2. Construct T's, bends, and elbows with radius of not less than 1-1/4 times diameter of duct on centerline.

2.2.3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.2.4. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated. Branch shall enter the main at the large end of the transition.

2.2.5. Ductwork must be finished, completely air and water tight, completely free from cracks, distortions, or other imperfections.

2.2.6. Ductwork shall be supported (or guided) at intervals not exceeding 8 feet on center. Black steel hangers, rods, and base support structures may be used. Securely fasten hangers and supports to avoid vibration and take care to avoid creating stress conditions.

2.2.7. Furnish and install flexible connections at fan connections. Fabricate flexible connections from fire resistant Neoprene-coated fiberglass cloth or other approved material. Where connecting to equipment, provide a support at the unsupported end of the connector. Weld, cement, or clamp the connector to the duct, and flange or band the connector to match the fan connection.

2.3. MANUFACTURED DUCTWORK AND FITTINGS.

2.3.1. Manufacture in accordance with SMACNA Round Industrial Duct Construction Standards and as indicated. Provide duct materials, gauges, reinforcing and sealing for the operating pressures indicated.

2.3.2. Elbows shall have at least 5 sections and bevels shall be pierced proportionately.

3. EXECUTION.

3.1. INSTALLATION.

3.1.1. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

3.1.2. Duct Sizes are inside clear dimensions.

3.1.3. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.

3.1.4. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

3.1.5. Use double nuts and lock washers on threaded rod supports.

3.1.6. Connect flexible duct to metal duct with draw bands.

ZERO ACCIDENTS

SECTION 15910

DUCTWORK ACCESSORIES

INDEX

- 1. GENERAL**
- 2. PRODUCTS**
- 3. EXECUTION**

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Backdraft dampers.**
- 1.1.2. Duct test holes.**
- 1.1.3. Flexible duct connections.**
- 1.1.4. Volume control dampers.**

1.2. RELATED SECTIONS.

- 1.2.1. Section 15890 - Ductwork.**

1.3. REFERENCES. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.4. SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only.

1.4.1. Submit under provisions of Section 01300 - Submittal Description.

1.4.2. SD01 Product Data; F.I.O. Provide for shop-fabricated assemblies including backdraft dampers, volume control dampers, duct test holes and hardware used.

1.4.3. SD04 Shop Drawings; F.I.O. Indicate for shop-fabricated assemblies including backdraft dampers, volume control dampers, and duct test holes.

1.5. DELIVERY, STORAGE, AND HANDLING.

1.5.1. Deliver, store, protect, and handle products to site, taking every precaution to prevent damage to the accessories.

1.5.2. Protect dampers from damage to operating linkages and blades.

2. PRODUCTS.

2.1. BACKDRAFT DAMPERS. Multi-blade, Parallel Action Gravity Balanced Backdraft Dampers. 16 gauge extruded aluminum with blades of a maximum of 6 inch width with flexible vinyl-sealed edges, linked together in a rattle-free manner with 90-degree stop, steel ball bearings and plated-steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.2. DUCT TEST HOLES. Cut or drill in ducts as required. Cap with threaded or twist-on metal caps.

2.3. FLEXIBLE DUCT CONNECTIONS. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Flexible and Metal, and as indicated.

2.4 VOLUME CONTROL DAMPERS. Fabricate in accordance with SMACNA Duct Construction Standards - Metal and Flexible, and as indicated.

2.4.1 Fabricate single-blade butterfly dampers with end bearings for duct sizes up to 10 inches in diameter.

2.4.1.1 Provide locking, indicating quadrant regulators.

2.4.2 Fabricate slide-gate dampers for ductwork larger than 10 inches in diameter.

3. EXECUTION.

3.1. INSTALLATION.

3.1.1. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Flexible and Metal. Refer to Section 15890 for duct construction and pressure class.

3.1.2. Provide backdraft damper on tank vent where indicated.

3.1.3. Provide duct test holes where indicated and required for testing and balancing purposes.

3.1.4. Provide flexible connections immediately adjacent to equipment in ducts associated with fans. For fans developing static pressures of 5.0 inches and over, cover connections with leaded vinyl sheet, held in place with metal straps.

ZERO ACCIDENTS

SECTION 15980

INSTRUMENTATION

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL

1.1. SECTION INCLUDES

- 1.1.1. Flow meters.
- 1.1.2. Level switches. See Section 11205.
- 1.1.3. pH Controls. See Section 11205.
- 1.1.4. Pressure Gages, Pressure Gage Taps and Diaphragm Seals.
- 1.1.5. Pressure Switches.
- 1.1.6. Temperature Elements, Transmitters and Controllers.
- 1.1.7. Thermometers and Thermometer Wells.
- 1.1.8. Static Pressure and Filter Gauges.

1.2. PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- 1.2.1. Section 15510 - Process Piping. Installation of thermometer wells and pressure gage tapings.

1.3. RELATED SECTIONS

- 1.3.1. Section 15985 - Sequence of Operation.

1.4. REFERENCES

- 1.4.1. ASME B40.1 - Gages - Pressure Indicating Dial Type -Elastic Element.
- 1.4.2. ASTM E1 - Specification for ASTM Thermometers.
- 1.4.3. ASTM E77 - Verification and Calibration of Liquid-in-Glass Thermometers.
- 1.4.4. AWWA C700 - Cold Water Meters - Displacement Type.
- 1.4.5. AWWA C706 - Direct Reading Remote Registration Systems for Cold Water Meters.
- 1.4.6. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- 1.4.7. FS-GG-G-76 - Gages, Pressure and Vacuum, Dial Indicating (for Air and Water).

- 1.5. SUBMITTALS. Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only.

- 1.5.1. Submit under provisions of Section 01300.

- 1.5.2. SD 01 Product Data F.I.O. Include list which indicates use, operating range, total range and location for manufactured components.

- 1.5.3. SD 06 Manufacturer's Installation Instruction F.I.O.

- 1.5.4. Submit manufacturer's installation instructions under provisions of Section 01300. Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

- 1.6. ENVIRONMENTAL REQUIREMENTS. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

1.7. DELIVERY, STORAGE AND HANDLING.

- 1.7.1. Deliver, store, protect and handle products to site taking every precaution to prevent damage to the instrumentation.

- 1.7.2. Delivery instruments to site in original factory packaging, labelled with manufacturer's identification.

- 1.7.3. Store instruments in original packages and protect from weather and construction activities.

- 1.7.4. Protect instruments against dirt, water, chemical and mechanical damage.

2. PRODUCTS

2.1. FLOW METERS. Variable area flowmeter with a range of 0-2 gpm suitable for liquid service with a maximum temperature of 200°F, a minimum of 32°F at a maximum pressure of 50 psi. Minimum accuracy of ±5%. Wetted materials to be compatible with diluted sulfuric acid with a pH of 2-4. Fittings for installation on a 1 inch stainless steel line.

2.2. PRESSURE GAGES

2.2.1. ASME B40.1, 4-1/2 inch (115 mm) diameter drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background, one percent mid-scale accuracy, scale calibrated in psi.

2.3. PRESSURE GAGE TAPS.

2.3.1. Gage Cock. Tee or lever handle, PVC or CPVC for maximum 150 psig @ 73°F, material selection based on line operating temperature.

2.3.2. Diaphragm Seals. Seal shall be the diaphragm type with glycerine as the fill fluid. Seals installed in the heating and recirculation system shall have Hastelloy C bodies and diaphragms. Seals installed in the scrubber piping system shall have steel bodies with 316 stainless steel diaphragms.

2.3.3. Pressure Switches. Pressure switch in a NEMA 4 enclosure with 2 SPDT switch contacts rated for a minimum of 5A at 120 VAC. Wetted materials to be suitable for clean water service. Pressure rated for 150 psi; switch setting shall be adjustable from 0-20 psig decreasing pressure.

2.3.4. Temperature Elements, Transmitters and Controllers.

2.3.4.1. Temperature Elements. Thermocouple or RTD devices in thermowells. Thermowells to be stainless steel with standard connection head, sized to fit each pipe location. Temperature element shall be suitable for use with the chosen thermowell and temperature transmitter. Minimum range 0-200°F.

2.3.4.2. Temperature Transmitter. Temperature transmitter is optimal and will only be required if needed by controller location or input requirements. Transmitter shall accept inputs from the chosen temperature element and output a 4-20 mA signal to the temperature controller. The transmitter shall be housed in a NEMA 4, 4X enclosure.

2.3.4.3. Temperature Controller. The temperature controller shall be capable of PID control with provisions for dual inputs of the type chosen for the temperature elements or transmitter. The controller shall be capable of alarming on one input and controlling on another. The alarm contacts will be rated for at least 5A @ 115 VAC. The controller shall operate on 115 VAC, 1 dia., 60 Hz, with an output signal of 4-20 mA. Sensor failure shall cause notification of the operator.

2.4. DIAL THERMOMETERS

2.4.1. ASTM E1, 3 inch (75 mm) diameter dial in stainless steel case, adjustable angle with external recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed glass lens, stainless steel stem, one percent of full scale accuracy, calibrated in degrees F.

2.5. THERMOMETER SUPPORTS

2.5.1. Socket. 316 stainless steel separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.6. STATIC PRESSURE GAGES

2.6.1. 3-1/2 inch (90 mm) diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment with tubing, static pressure tips.

3. EXECUTION

3.1. INSTALLATION

3.1.1. Install in accordance with manufacturer's instructions.

3.1.2. Provide one pressure gage per pump, installing taps on discharge of pump. Pipe to gage.

3.1.3. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer

sockets.

3.1.4. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets.

3.1.5. Provide instruments with scale ranges selected according to service with largest appropriate scale.

3.1.6. Install gages and thermometers in locations where they are easily read from normal operating level.

ZERO ACCIDENTS

SECTION 15985

SEQUENCE OF OPERATION

INDEX

1. GENERAL
2. EXECUTION

1. GENERAL

1.1. SECTION INCLUDES.

- 1.1.1. Heating and recirculation system.
- 1.1.2. Emission control system.

1.2. **SYSTEM DESCRIPTION.** This Section defines the manner and method by which controls function during Phase One to heat and recirculate the dilution fluid (brine) and control emissions, and to control emissions during Phase Two (decontamination). Equipment, devices, and system components required for control are provided under other sections of this specifications.

2. EXECUTION.

2.1. EMISSION CONTROL SYSTEM (PHASE ONE).

2.1.1. Fill scrubber D102's sump. High level switch LSH-140 closes the utility water "fill" solenoid.

2.1.2. Start pump P104 through "start-stop" pushbutton on starter at equipment skid. Scrubber D102 sump water level above LSL-140 set point - pump starts.

2.1.3. Start fan BL-102 through the "start-stop" pushbutton on starter at equipment skid.

2.1.4. Controller pH-C calling for addition of 50% sulfuric acid solution; and pump P-104 running; pump P-107 starts.

2.1.5. Fluid level in D102 sump drops below set point of LSL-140, utility water flow solenoid opens and remains open until LSH-140 set point is reached.

2.1.6. Fluid level in D102 sump drops below LSL-140 set point; P-104 stops.

2.1.7. Pump P-104 fails during Phase One, activate pump P-105.

2.1.8. Power failure during Phase One, activate emergency generator.

2.2. HEATING AND RECIRCULATION SYSTEM (PHASE ONE).

2.2.1. Start pumps P-101 and 102 through "start-stop" pushbuttons on starters at equipment skids. Seal water pressure is ok -- pumps start.

2.2.2. Start up heat source in accordance with the manufacturer's instructions after making sure that all safety interlocks are functioning as required. Set the thermal fluid temperature control at 300°F.

2.2.3. Control thermal fluid bypass valve at each heat exchanger for a 158°F brine temperature leaving the heat exchanger with a 140°F high limit temperature for brine entering the heat exchanger.

2.2.4. When the brine temperature from Tank 102 reaches 140°F (or a lower temperature that dissolves the "salt" crystals), temperature shall be held for a period as directed by the Rocky Mountain Arsenal's representative, but not to exceed 120 hours. During this holding period, the operator shall reduce the thermal fluid temperature as required to provide a rough load balance. The thermal fluid bypass valve will function to provide fine tuning of flow to hold the brine at the set point temperature (140°F maximum).

2.2.5. At the end of the holding period, fluid will be withdrawn from Tank 102 and transported to Pond A, thus completing Phase One of the operation.

2.3. EMISSION CONTROL SYSTEM (PHASE TWO - DECONTAMINATION).

2.3.1. Fill scrubber D101 sump. Level switch LSH-130 closes the utility water "fill" solenoid when set point is reached.

2.3.2. Start pump P-103 through "start-stop" pushbutton on starter at equipment skid. Scrubber D101 sump water level above LSSL-130 set point - pump P-103 starts.

2.3.3. Start fan BL-101 through "start-stop" pushbutton on starter at equipment skid.

2.3.4. Controller pHc 130 calling for addition of 50% sulfuric acid solution and pump P-103 running; pump P-106 starts.

2.3.5. Fluid level in scrubber D101 sump drops below level switch LSL-130 set point; utility water "fill" solenoid opens and remains open until level switch LSH-130 set point is reached.

2.3.6. Fluid level in scrubber D101 sump drops below LSSL-130 set point; pump P-103 stops.

2.3.7. Pump P-103 fails during Phase Two; shut down emission control system, repair pump, and proceed with Phase Two decontamination.

2.3.8. Power fails during Phase Two; resume Phase Two decontamination upon restoration of power.

ZERO ACCIDENTS

SECTION 16111

CONDUIT

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Metal conduit.
- 1.1.2. Liquid-tight flexible metal conduit.
- 1.1.3. Nonmetallic conduit.
 - 1.1.3.1. Fittings and conduit bodies.

1.2. REFERENCES.

- 1.2.1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- 1.2.2. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- 1.2.3. ANSI/NFPA 70 - National Electrical Code.
- 1.2.4. NECA "Standard of Installation."
- 1.2.5. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- 1.2.6. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3. DESIGN REQUIREMENTS.

- 1.3.1. Conduit Size: ANSI/NFPA 70.

1.4. REGULATORY REQUIREMENTS.

- 1.4.1. Conform to requirements of ANSI/NFPA 70.
- 1.4.2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

1.5. DELIVERY, STORAGE, AND HANDLING.

- 1.5.1. Accept conduit on site. Inspect for damage.
- 1.5.2. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- 1.5.3. Protect PVC conduit from sunlight.

1.6. PROJECT CONDITIONS.

- 1.6.1. Verify that field measurements are as shown on Drawings.
- 1.6.2. Verify routing and termination locations of conduit prior to rough-in.
- 1.6.3. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

2. PRODUCTS.

2.1. CONDUIT REQUIREMENTS.

- 2.1.1. Minimum Size: 3/4 inch, unless otherwise specified.
- 2.1.2. More than one foot from Foundation Wall: Use thickwall nonmetallic conduit.
- 2.1.3. Within one foot from Foundation Wall: Use rigid steel conduit.
 - 2.1.3.1. Minimum Size: 3/4 inch.
- 2.1.4. Outdoor Locations, Above Grade: Use rigid steel conduit.
- 2.1.5. Wet and Damp Locations: Use rigid steel conduit.
- 2.1.6. Dry Locations:
 - 2.1.6.1. Concealed: Use rigid steel conduit.
 - 2.1.6.2. Exposed: Use rigid steel conduit.

2.2. METAL CONDUIT.

- 2.2.1. Rigid Steel Conduit: ANSI C80.1.

2.2.2. Fittings and Conduit Bodies: ANSI/NEMA FB 1;
material to match conduit.

2.3. LIQUID-TIGHT FLEXIBLE METAL CONDUIT.

2.3.1. Description: Interlocked steel construction with PVC jacket.

2.3.2. Fittings: ANSI/NEMA FB 1.

2.3.3. Description: NEMA TC 2; Schedule 40 PVC.

2.3.4. Fittings and Conduit Bodies: NEMA TC 3.

2.4. RIGID NONMETALLIC CONDUIT.

2.4.1. Description: NEMA TC 2; Schedule 40 PVC.

2.4.2. Fittings and conduit bodies: NEMA TC 3.

3. EXECUTION.

3.1. INSTALLATION.

3.1.1. Install conduit in accordance with NECA "Standard of Installation."

3.1.2. Install nonmetallic conduit in accordance with manufacturer's instructions.

3.1.3. Install pull boxes as necessary to maintain proper cable tension.

3.1.4. Arrange supports to prevent misalignment during wiring installation.

3.1.5. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

3.1.6. Group related conduits; support using conduit rack. Construct rack using steel channel.

3.1.7. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

3.1.8. Arrange conduit to maintain head room and present neat appearance.

3.1.9. Route conduit parallel and perpendicular to walls.

3.1.10. Maintain adequate clearance between conduit and piping.

3.1.11. Maintain 12-inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104° F (40° C).

3.1.12. Cut conduit square using saw or pipecutter; de-burr cut ends.

3.1.13. Bring conduit to shoulder of fittings; fasten securely.

3.1.14. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

3.1.15. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

3.1.16. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch (50 mm) size.

3.1.17. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

3.1.18. Provide suitable pull string in each empty conduit except sleeves and nipples.

3.1.19. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

3.1.20. Ground and bond conduit under in accordance with NFPA 70.

ZERO ACCIDENTS

SECTION 16123

WIRE AND CABLE

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Wire and cable.
- 1.1.2. Wiring connectors and connections.

1.2. QUALIFICATIONS.

1.2.1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.3. REGULATORY REQUIREMENTS.

- 1.3.1. Conform to requirements of ANSI/NFPA 70.
- 1.3.2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

1.4. FIELD SAMPLES.

- 1.4.1. Submit one 18-inch length of cable assembly from each reel.
- 1.4.2. Select each length to include complete set of manufacturer markings.

1.4.3. Attach tag indicating cable size and application information.

1.5. PROJECT CONDITIONS.

- 1.5.1. Verify that field measurements are as shown on Drawings.
- 1.5.2. Conductor sizes are based on copper.
- 1.5.3. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- 1.5.4. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.6. COORDINATION.

- 1.6.1. Determine required separation between cable and other work.
- 1.6.2. Determine cable routing to avoid interference with other work.

2. PRODUCTS.

2.1. UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE.

- 2.1.1. Description: ANSI/NFPA 70, Type UF.
- 2.1.2. Conductor: Copper.
- 2.1.3. Insulation Voltage Rating: 600 volts.
- 2.1.4. Insulation: 75 degrees C, type THW or THWN.

2.2. CONTROL CABLE.

- 2.2.1. Description: Multi-conductor insulated wire.
- 2.2.2. Conductor: copper.
- 2.2.3. Insulation Voltage Rating: 600 volts.
- 2.2.4. Insulation Material: EPR, XLPE, or XHHW.
- 2.2.5. Jacket: Required only when cable is to be direct buried, jacket will be rated for direct burial.

3. EXECUTION.

3.1. EXAMINATION.

- 3.1.1. Verify that mechanical work likely to damage wire and cable has been completed.

- 3.2. PREPARATION.
 - 3.2.1. Completely and thoroughly swab raceway before installing wire.
- 3.3. WIRING METHODS.
 - 3.3.1. Exterior Locations: Use underground feeder and branch circuit cable in raceway.
 - 3.3.2. Underground Installations: Use underground feeder and branch circuit cable in raceway.
 - 3.3.3. Control cable: Use control cable in raceway.
- 3.4. INSTALLATION.
 - 3.4.1. Install products in accordance with manufacturers' instructions.
 - 3.4.2. Use stranded conductors for control circuits.
 - 3.4.3. Use conductor not smaller than 12 AWG for power and lighting circuits.
 - 3.4.4. Use conductor not smaller than 14 AWG for control circuits.
 - 3.4.5. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
 - 3.4.6. Pull all conductors into raceway at same time.
 - 3.4.7. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
 - 3.4.8. Protect exposed cable from damage.
 - 3.4.9. Use suitable cable fittings and connectors.
 - 3.4.10. Neatly train and lace wiring inside boxes, equipment, and panelboards.
 - 3.4.11. Clean conductor surfaces before installing lugs and connectors.
 - 3.4.12. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 3.4.13. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
 - 3.4.14. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- 3.5. FIELD QUALITY CONTROL.
 - 3.5.1. Inspect wire and cable for physical damage and proper connection.
 - 3.5.2. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
 - 3.5.3. Verify continuity of each branch circuit conductor.

ZERO ACCIDENTS
SECTION 16170
GROUNDING AND BONDING

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Grounding electrodes and conductors.
- 1.1.2. Equipment grounding conductors.
- 1.1.3. Bonding.

1.2. REFERENCES.

- 1.2.1. ANSI/NFPA 70 - National Electrical Code.
- 1.2.2. Grounding electrode system.

1.3. PERFORMANCE REQUIREMENTS.

- 1.3.1. Grounding System Resistance: 5 ohms.

1.4. PROJECT RECORD DOCUMENTS.

- 1.4.1. Accurately record actual locations of grounding electrodes.
- 1.4.2. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

1.5. QUALIFICATIONS.

- 1.5.1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

1.6. REGULATORY REQUIREMENTS.

- 1.6.1. Conform to requirements of ANSI/NFPA 70.
- 1.6.2. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

2. PRODUCTS.

2.1. ROD ELECTRODE.

- 2.1.1. Material: Copper.
- 2.1.2. Diameter: 3/4 inch.
- 2.1.3. Length: 10 feet.

2.2. MECHANICAL CONNECTORS.

- 2.2.1. Description: Cable to rod mechanical or welded connection sized as shown on the Drawings.
- 2.2.2. Material: Bronze.

2.3. WIRE.

- 2.3.1. Material: Stranded copper.
- 2.3.2. Ground Ring: 4/0 soft-drawn bare copper.
- 2.3.3. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

2.4. GROUNDING WELL COMPONENTS.

- 2.4.1. Well Pipe: 8-inch (200 mm) diameter by 24-inch (600 mm) long clay tile pipe with belled end.

- 2.4.2. Well Cover: Cast iron with legend "GROUND" embossed on cover.

3. EXECUTION.

3.1. EXAMINATION.

- 3.1.1. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2. INSTALLATION.

- 3.2.1. Install products in accordance with manufacturer's instructions.

3.2.2. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

3.2.3. Provide grounding well pipe with cover at rod locations, where indicated. Install well pipe top flush with finished grade.

3.2.4. Provide bonding to meet Regulatory Requirements.

3.2.5. Bond together metal siding not attached to grounded structure; bond to ground.

3.2.6. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.3. FIELD QUALITY CONTROL.

3.3.1. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.3.2. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

ZERO ACCIDENTS

SECTION 16264

DIESEL-GENERATOR SET WITH AUXILIARIES

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. REFERENCES. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2 (1990) National Electrical Safety Code
ANSI C39.1 (1981) Electrical Analog Indicating Instruments

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 975 (1989a) Diesel Fuel Oils

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 43 (1974; R 1985) Testing Insulation Resistance of Rotating Machinery

IEEE Std 95 (1977; R 1982) Insulation Testing of Large AC Rotating Machinery With High Direct Voltage

IEEE Std 115 (1983) Test Procedures for Synchronous Machines

MILITARY STANDARDS (MIL-STD)

MIL-STD 705 (Rev C) Generator Sets, Engine Driven Methods of Tests and Instructions

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1 (1986; Rev 1) Molded Case Circuit Breakers and Molded Case Switches

NEMA ICS 2 (1988; Rev 1) Industrial Control Devices, Controllers and Assemblies

NEMA ICS 6 (1988; Rev 1) Enclosures for Industrial Control and Systems

NEMA MG 1 (1987; Rev 1) Motors and Generators

NEMA MG 2 (1989) Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

NEMA SG 3 (1981) Low-Voltage Power Circuit Breakers

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30 (1987) Flammable and Combustible Liquids

NFPA 70

(1990) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE ARP 892

(Nov 1965) DC Starter-Generator, Engine

UNDERWRITERS LABORATORIES (UL)

UL 489

(Sep 15, 1986; 7th Ed; Rev thru Oct 24, 1990) Molded-Case
Circuit Breakers and Circuit-Breaker Enclosures

UL 1236

(Dec 23, 1986; 3rd Ed; Rev thru Apr 6, 1990) Battery
Chargers

1.2. **SYSTEM DESCRIPTION.** The engine-generator set shall be leased and installed complete and totally functional, with all necessary ancillary equipment including air filtration, starting system, generator protection and isolation, instrumentation, lubrication, fuel system, cooling system, and engine exhaust. Engine-generator set ratings shall be as follows:

Number of Sets	1
Rating	Standby
Fuel Type	No. 2-D or gasoline
Output	45 kW
Power factor, lagging	0.8
Maximum speed	1800 rpm
Frequency	60 Hz
Voltage	480/277 VAC
Phase	3 phase, 4 wire
Overload capacity	110 percent of rated load for 1 hour in 12 consecutive hours
Maximum time to start (with a load equal to the maximum step load increase)	30 seconds
Elevation of installation	5400 feet above sea level
Maximum summer outdoor temperature	110 degrees F
Engine Cooling type	water
Area Type	Industrial
Seismic Zone	1
Maximum Step Load Increase	100 percent rated capacity
Maximum Step Load Decrease	100 percent of rated capacity

1.3. **GENERAL REQUIREMENTS.**

1.3.1. **Engine-Generator Set.** Each set shall consist of one engine, one generator, and one exciter mounted, assembled, and aligned on one base; and all other necessary ancillary equipment which may be mounted

separately. Sets shall be assembled and attached to the base prior to shipping. All set components shall be environmentally suitable for the locations shown and shall be the manufacturer's standard product offered in catalogs for commercial or industrial use. Any non-standard products or components and the reason for their use shall be specifically identified in paragraph SUBMITTALS. It is anticipated that the Contractor will supply a portable set with breakers and transfer switch.

1.3.2. **Personnel Safety Devices.** Exposed moving parts, parts that produce high operating temperatures, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. The safety devices shall be installed so that proper operation of the equipment is not impaired.

1.3.3. **Conformance to Codes and Standards.** Where equipment is specified to conform to requirements of any code or standard such as the UL, etc., the design, fabrication, and installation shall all conform to the code.

1.4. **SUBMITTALS.** Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 - SUBMITTAL DESCRIPTIONS.

1.4.1 **Manufacturer's Catalog Data.** GA1. Manufacturer's standard catalog data describing and depicting each engine-generator set and all ancillary equipment in sufficient detail to demonstrate complete specification compliance.

1.5. **STORAGE AND INSTALLATION.** Proper protection of all material and equipment, before, during, and after installation is the Contractor's responsibility. All stored items shall be protected from the weather and contamination. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

2. PRODUCTS.

2.1. **MATERIALS AND EQUIPMENT.** Materials and equipment shall be as specified herein.

2.1.1. Battery.

2.1.1.1. Starting: SAE J537

2.1.1.2. Charger: UL 1236.

2.1.2. Circuit Breakers, Low-Voltage. NEMA AB 1, UL 489, and NEMA

SG 3.

2.1.3. Electrical Indicating Instruments, Analog. ANSI C39.1,

semiflush.

2.1.4. Filter Elements (Fuel-oil, Lubricating-oil, and

Combustion-air). Manufacturer's Standard.

2.1.5. Generator and Exciter. NEMA MG 1 and NEMA MG 2.

2.1.6. Instrument Transformers. ANSI C12.11.

2.1.7. Thermometer for Oil or Water Service. Flush-mounted dial

with range to suit the service encountered and shall be standard with the manufacturer.

2.1.8. Electrical Enclosures. NEMA ICS 6, TYPE 3R.

2.1.9. Pressure Gauges. Manufacturer's Standards.

2.1.10. Electric Motors.

2.1.10.1 Starting Motors. SAE ARP-892

2.2. ENGINE.

2.2.1. **Type.** The engine shall operate on No. 2-D diesel or gasoline. It shall be designed for portable applications and shall be complete with all ancillaries. It shall be a standard production model described in the manufacturer's catalog. It shall be naturally aspirated.

2.2.2. **Transient Load Capability.** The engine shall be capable of receiving and responding to a maximum step load change within a transient loading recovery time as specified in paragraph SYSTEM DESCRIPTION.

2.2.3. **Filter.** One full-flow filter shall be provided for each engine. The strainer and filter shall be readily accessible and capable of being changed without disconnecting or disturbing other components. The filter shall be located on the discharge side of the main pump. The filter shall have inlet

and outlet connections plainly marked. An indicating differential pressure gauge shall be provided across the filter.

2.2.3.1 **Capacity, Standby Rated.** The Contractor shall ensure an adequate supply of fuel for operation during all power outages.

2.2.3.2 **Local Fuel Fill.** The local fuel fill port on the day tank shall have a screw on cap.

2.3. **LUBRICATION.** Each engine shall have a separate lube-oil system. Each system shall be pressurized by engine-driven oil pumps. The engine shall be furnished with a dip-stick for oil level indications. The system shall be readily accessible for service such as draining, refilling, etc. Each system shall permit addition of oil and have oil-level indication with the set operating. The system shall utilize an oil cooler as recommended by the engine manufacturer.

2.3.1. **Filtering.** One full-flow filter shall be provided for each pump. The filter shall be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. The filter shall be located on the discharge side of each pump. The filter shall have inlet and outlet connections plainly marked. An indicating differential pressure gauge shall be provided across the filter.

2.4. **COOLING.** Each engine shall have its own cooling system. Each system shall operate fully automatic while the engine is running. The maximum temperature rise of the coolant across the engine shall be no more than that recommended.

2.5. **GOVERNOR.** A governor shall be provided. It shall be configured for safe manual adjustment during operation of the engine-generator set of the frequency setting without special tools, from 90 to 110 percent of the rated frequency.

2.5.1. **Steady State Performance.** The governor shall automatically maintain the generator output frequency within the specified bandwidth.

2.6. **GENERATOR.**

2.6.1. **General.** The generator shall be one or two bearing, engine-driven synchronous type directly connected to the engine and shall conform to NEMA MG 1. Frame shall be drip-proof type. The generator and all ancillary equipment shall meet the short circuit requirements of NEMA MG 1.

2.7. **VOLTAGE REGULATOR.** The regulator shall have an operational bandwidth of 2 percent of rated voltage. The regulator shall be configured for safe manual adjustment of the engine-generator voltage output without special tools, during operation, from 90 to 110 percent of the rated voltage.

2.7.1. **Steady State Performance.** The voltage regulator shall automatically maintain the generator output voltage within the specified operational bandwidth.

2.7.2. **Transient Voltage Performance.** The voltage regulator shall cause the engine-generator set to respond to a maximum step load change within the transient loading recovery time as specified in paragraph SYSTEM DESCRIPTION, to limit the maximum voltage variation to 5 percent of rated voltage.

2.8. **GENERATOR CONTROL AND PROTECTION.** A 600 volt rated, molded case with shunt trip circuit breaker to provide short circuit and overload protection for the generator shall be provided. Molded case circuit breakers shall have a minimum continuous current rating of 138 percent of the generator output rating, a frame size to equal the switchboard continuous rating, and an interrupting rating not less than 20,000 amperes at rated voltage and frequency. Equipment shall be ground fault protected. All breaker ratings shall be at the generator rated voltage and frequency. The breaker shall be housed in an engine generator base mounted-type enclosure.

2.9. **MANUAL TRANSFER SWITCH.** Manual transfer switch shall be electrically operated, mechanically held, selected by control switch mounted in switch cover. Switch shall be rated for 480 volts, 3 phase, 3 wire 60 Hz with 3 switched poles. Continuous current rating of 75A with an interrupting capacity of 100 percent of continuous rating. Withstand current rating of 20,000 RMS symmetrical amperes.

2.10. **MANUAL ENGINE-GENERATOR SET SYSTEM OPERATION.** Complete facilities shall be provided for manual:

- a. Loading and unloading

3. EXECUTION.

3.1. **ELECTRICAL INSTALLATION.** Electrical installation shall comply with NFPA 70, and ANSI C2.

3.2. **ONSITE INSPECTION AND TESTS.** The following tests shall be performed after the complete installation of each engine-generator set and its associated equipment. Data taken during engine runs shall be recorded in at least 20 minute intervals and shall include all electrical, pressure, and temperature information available.

3.2.1. **Power Factor.** All load runs shall be made at 0.8 power factor.

3.2.2. **Contractor Supplied.** The Contractor shall provide all equipment and supplies required for inspections and tests including fuel, test instruments, loadbanks at the specified power factors, etc.

3.2.3. **Instruments.** All panel gauges, meters, displays, instruments, etc., provided under this specification shall be verified during all test runs by test instruments of greater precision and accuracy. All test instruments shall be calibrated by a recognized standards laboratory within 30 days prior to testing.

3.2.3.1. **Insulation Test.** The generator and exciter circuits insulation resistance shall be tested with an insulation tester. Stator readings shall be taken at circuit breaker. All results of insulation resistance tests shall be recorded. Readings shall be within limits specified by the manufacturer. Mechanical operation, insulation resistance, and protective relay calibration and operation shall be verified prior to starting engine operation for testing as specified herein. Precautions shall be taken to preclude damaging generator components during test.

3.2.3.2. **Electrical Protective Device Tests.** Protective devices shall be visually and mechanically inspected, adjusted, tested, and calibrated in accordance with the manufacturers published instructions. Device ratings, settings, and operation shall be documented.

3.2.3.3. **Safety Run Test.**

a. Engine manufacturer's recommended prestarting checks and inspections shall be performed and recorded. Coolant fluid, fuel, and lube-oil levels shall be checked.

b. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

c. Operate the engine generator-set for at least 2 hours at 75 percent of rated load.

d. Verify proper operation of all controls.

e. Verify proper operation and setpoints of all gauges and

instruments.

f. Verify proper operation of all ancillary equipment.

g. Activate the manual emergency stop switch.

h. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of rated load.

i. Manually adjust the governor to increase engine speed past the overspeed limit. Record the RPM at which the engine shuts down.

3.2.3.4. **Engine Load Run Test.** The engine load run test shall be accomplished during daylight hours.

a. Perform and record all engine manufacturer's recommended prestarting checks and inspections. Include as a minimum checking coolant fluid, fuel, and lube-oil levels.

b. Start the engine, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

c. Operate the engine generator-set for at least 2 hours at 75 percent of rated load.

- d. Increase load to 100 percent of rated load and operate the engine generator-set for at least 2-hours.
- e. Shut down the engine.

ZERO ACCIDENTS
SECTION 16461
DRY TYPE TRANSFORMERS

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Dry type two winding transformers.

1.2. RELATED SECTIONS.

- 1.2.1. Section 16111 - Conduit: Flexible conduit connections.
- 1.2.2. Section 16170 - Grounding and Bonding.

1.3. REFERENCES.

- 1.3.1. NEMA ST 20 - Dry Type Transformers for General Applications.
- 1.3.2. NFPA 70 - National Electrical Code.

1.4. QUALIFICATIONS.

- 1.4.1. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years experience.

1.5. REGULATORY REQUIREMENTS.

- 1.5.1. Conform to requirements of NFPA 70.
- 1.5.2. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.6. DELIVERY, STORAGE, AND HANDLING.

- 1.6.1. Deliver transformers individually wrapped for protection and mounted on shipping skids.
- 1.6.2. Accept transformers on site. Inspect for damage.
- 1.6.3. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- 1.6.4. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

2. PRODUCTS.

2.1. TWO-WINDING TRANSFORMER.

- 2.1.1. Description: NEMA ST 20, factory assembled, air cooled dry type transformer, single phase, 25KVA, 480V to 120/240V, taps at +2-2.5% and -2-2.5%, in a NEMA 3R enclosure.

3. EXECUTION.

3.1. EXAMINATION.

- 3.1.1. Verify that surfaces are suitable for installing transformer supports.

3.2. INSTALLATION.

- 3.2.1. Install Products in accordance with manufacturer's instructions.
- 3.2.2. Set transformer plumb and level.
- 3.2.3. Use flexible conduit, under the provisions of Section 16111, 2 ft (0.6 M) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- 3.2.4. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- 3.2.5. Provide seismic restraints.
- 3.2.6. Provide grounding and bonding in accordance with Section 16170.

3.3. FIELD QUALITY CONTROL.

3.3.1. Check for damage and tight connections prior to energizing transformer.

3.3.2. Measure primary and secondary voltages and make appropriate tap adjustments.

ZERO ACCIDENTS
SECTION 16476
CIRCUIT BREAKERS
INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. SECTION INCLUDES.

- 1.1.1. Enclosed molded case circuit breakers.

1.2. REFERENCES.

1.2.1. FS W-C-375 - Circuit Breakers, Molded Case, Branch Circuit and Service.

- 1.2.2. NEMA AB 1 - Molded Case Circuit Breakers.

1.3. SUBMITTALS.

- 1.3.1. Submit manufacturers installation instructions.

1.4. REGULATORY REQUIREMENTS.

1.4.1. Use circuit breakers and panel listed by Underwriter's Laboratories, Inc., and suitable for specific application.

2. PRODUCTS.

2.1. MOLDED CASE CIRCUIT BREAKERS

2.1.1. Circuit Breaker: NEMA AB 1, frame and trip ratings as shown on drawings.

2.2. ENCLOSURES

- 2.2.1. Enclosure: NEMA AB 1; 1.

- 2.2.2. Fabricate enclosure from steel.

- 2.2.3. Finish using manufacturer's standard enamel finish color.

3. EXECUTION.

3.1. EXAMINATION

- 3.1.1. Verify that surfaces are ready to receive work.

- 3.1.2. Verify field measurements are as shown on Drawings.

3.1.3. Verify that required utilities are available, in proper location, and ready for use.

3.1.4. Beginning of installation means installer accepts conditions.

3.2. INSTALLATION.

3.2.1. Install enclosed circuit breakers where shown on Drawings, in accordance with manufacturer's instructions.

3.3. ADJUSTING.

3.3.1. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.

3.3.2. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

3.4. FIELD QUALITY CONTROL.

- 3.4.1. Inspect and test each circuit breaker to NEMA AB 1.

3.4.2. Inspect visually and perform several mechanical ON-OFF operations on each circuit breaker.

- 3.4.3. Verify circuit continuity on each pole in closed position.

3.4.4. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.

- 3.4.5. Include description of testing and results in test report.

ZERO ACCIDENTS

SECTION 16480

MOTOR CONTROL

INDEX

1. GENERAL
2. PRODUCTS
3. EXECUTION

1. GENERAL.

1.1. WORK INCLUDED.

- 1.1.1. Magnetic motor starters.

1.2. REFERENCES.

- 1.2.1. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- 1.2.2. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

1.3. OPERATION AND MAINTENANCE DATA.

- 1.3.1. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.4. DELIVERY, STORAGE, AND HANDLING.

- 1.4.1. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- 1.4.2. Handle in accordance with manufacturer's written instructions.

2. PRODUCTS.

2.1. MAGNETIC MOTOR STARTERS.

- 2.1.1. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- 2.1.2. Full Voltage Starting: Non-reversing type.
- 2.1.3. Reduced Voltage Starting: Auto transformer type.
- 2.1.4. Coil Operating Voltage: 120 volts, 60 Hertz.
- 2.1.5. Size: NEMA ICS 2; size as shown on Drawings.
- 2.1.6. Overload Relay: NEMA ICS 2; bimetal.
- 2.1.7. Enclosure: NEMA ICS 6; Type 3R.
- 2.1.8. Auxiliary Contacts: NEMA ICS 2; two normally open and 2 normally closed contacts in addition to seal-in contact.
- 2.1.9. Pushbuttons: NEMA ICS 2; START/STOP in front cover.
- 2.1.10. Indicating Lights: NEMA ICS 2; RUN: red, OFF: green in front cover.
- 2.1.11. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.
- 2.1.12. Control Power Transformers: 120 volt secondary, 250 VA minimum, in each motor starter.

3. EXECUTION.

3.1. INSTALLATION.

- 3.1.1. Install motor control equipment in accordance with manufacturer's instructions.
- 3.1.2. Select and install heater elements in motor starters to match installed motor characteristics.
- 3.1.3. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.